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WRIGHT LABORATORY

PDES APPLICATION PROTOCOL SUITE FOR COMPOSITES (PAS-C)

IDEF0 Activity Models and Information Needs for the PAS-C Program

South Carolina Research Authority (SCRA)
5300 International Blvd.
N. Charleston, SC 29418

March 1992

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PREPARED FOR:

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13 Feb 92

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13. ABSTRACT
This document addresses the requirements gathering process of an informational needs analysis for composite parts. A standard set of composite terminology and informational constructs were updated based on expert review and a comparison to other standards organizations' composite terminology. This updated terminology provides a framework for organizing and capturing the information into a usable/reusable structure. The scope of the needs analysis focused in the areas of Analysis, Design and Manufacturing. An overall functional node tree and IDEF0 models that establish the informational requirements are included. An attempt was also made to extract from composite experts a set of unique composite part characteristics.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AAM	Application Activity Model
ACSP	Aircraft Composite Structural Part
AIM	Application Interpreted Model
ALC	Air Logistics Center
AP	Application Protocol
ARM	Application Reference Model
AS	Application Protocol Suites
ASTM	American Society for Testing and Materials
ATLM	Automatic Tape Laying Machine
BOM	Bill of Materials
CBA	Cost Benefit Analysis
CSP	Core Stiffened Panel
CSL	Contoured Skin Laminate
DoD	Department of Defense
EAMR	Engineering Advanced Material Requests
ENG	Engineering
FEA	Finite Element Analysis
FW/BB	Framework/Building-Block
ICOM	Input, Control, Output, Mechanism
IPD	Integrated Product Development
IPO	IGES/PDES Organization
IRB	Industry Review Board
ISO	International Standards Organization
IML	Inner Mold Line
M&P	Materials & Processes
MFG	Manufacturing
OML	Outer Mold Line
PAS-C	PDES Application Protocol Suite for Composites
PD	Product Data
PDD	Product Definition Data
PDES	Product Data Exchange using STEP
QA	Quality Assurance
QFD	Quality Function Deployment
RFP	Request for Proposal
RPCM	Rapid Ply Cutting Machine
SOTA	State-of-the-Art
STEP	Standard for the Exchange of Product Model Data
TCA	"T" Composite Assembly
UOF	Units-of-Functionality
VIG	Vendor Implementation Group

1 INTRODUCTION

There have been many attempts to analyze the informational needs that support data exchange of composite part data between composite part life-cycle applications. The challenge for the PAS-C Program has been to scope the needs gathering process into a structured, achievable task that provides usable/reusable knowledge. What has been lacking in previous needs analyses was an overall methodology that allows for the informational needs of all aspects of composite parts to be captured. The PAS-C Program will introduce a generic structure for composite part information that facilitates this overall methodology. This overall methodology also manages and utilizes existing needs gathering methods to capture existing composite needs analyses and allows for the reusability of information. The difficulty in establishing this overall methodology was the required standardization of terminology and informational constructs throughout industry. The following sub-sections define the purpose and scope of this document as well as a brief description of the methodology and approach that was used. A management overview of PAS-C is provided for readers not familiar with this program.

1.1 Document Purpose

This document records the functional activities within the life-cycle of a composite part and the information that is exchanged between and within these functional activities. The functional activities addressed include Analysis, Design, and Build. The target use of this information is to formulate and create a PDES Application Protocol Suite for Composites (PAS-C). Sections 2.1.2 and 2.3 of the PAS-C interim document, Functional Needs Report for the PAS-C Program (Doc. No: PASC002.01.00), have been updated and incorporated in this document. The body of this document, section 2 Methodology, is divided into four major sections:

2.1 Overall Methodology

Defines the overall methodology for performing the needs analysis and establishing an informational framework.

2.2 Scope of Needs Analysis

Defines the part families used to scope the functional activities, the functional activities, and the building-blocks used to define the information requirements.

2.3 Activity Models

Contains the activity models which identify informational exchange areas.

2.4 Information Needs

Documents the composite part information required within each functional view domain as defined by project experts.

This document will also be used as a reference for establishing the information requirements for Application Protocols within a composite part life-cycle. The document contains a framework for collecting and maintaining this information. It does this by establishing a standard set of constructs for composite parts. This standard set of constructs and other composite terminology are defined in section 2.1.

1.2 Project Approach

An objective of the PAS-C team is to create and utilize a methodology that addresses the challenges of collecting and organizing composite part informational needs to the level of detail required for PDES (Product Data Exchange using STEP) implementation. PDES implementation is done through Application Protocols (APs). An Application Protocol is an information model within a product data exchange standard that defines the information transfer between or within specific application view(s). The PAS-C program has established a framework for an integrated suite of composite APs and in later phases will develop internal APs relative to the suite. The basic methodology used to perform this needs analysis is captured through the following activities:

- Establish a Framework/Building-Block (FW/BB) structure, including formalizing a standard set of composite items/components and functional views.
- Select a sample part set of composite parts that are commonly used in the Aircraft industry, and identify payback potential for utilizing them in a PDES/STEP (Standard for the Exchange of Product Model Data) environment.
- Collect the functional life-cycle activities associated with Aircraft Composite Structural Components by interviewing composite experts.
- Build Activity Models (IDEF0s) depicting exchanges of information between functional activities.
- Identify and document informational characteristics of composite items/components based on life-cycle functional views by interviewing composite experts.

1.3 Project Scope

The scope of the PAS-C needs analysis was limited to areas within and between the functions of Analysis, Design, and Build. Three part families were selected to limit the scope of the activities that were analyzed. These part families are as follows: (Detail part family information is contained in section 2.2.1)

- Ply Laminate - Contoured Skin Laminate
- Composite Layup/Assembly - Core Stiffened Panel

- Composite Layup/Assembly - "T" Composite Assembly

Even though the PAS-C scope is limited to these three part families, the FW/BB structure is expandable so that additional knowledge of new and/or different composite part families and functional views can be incorporated. The boxes in Figure 1 depict the major functional views

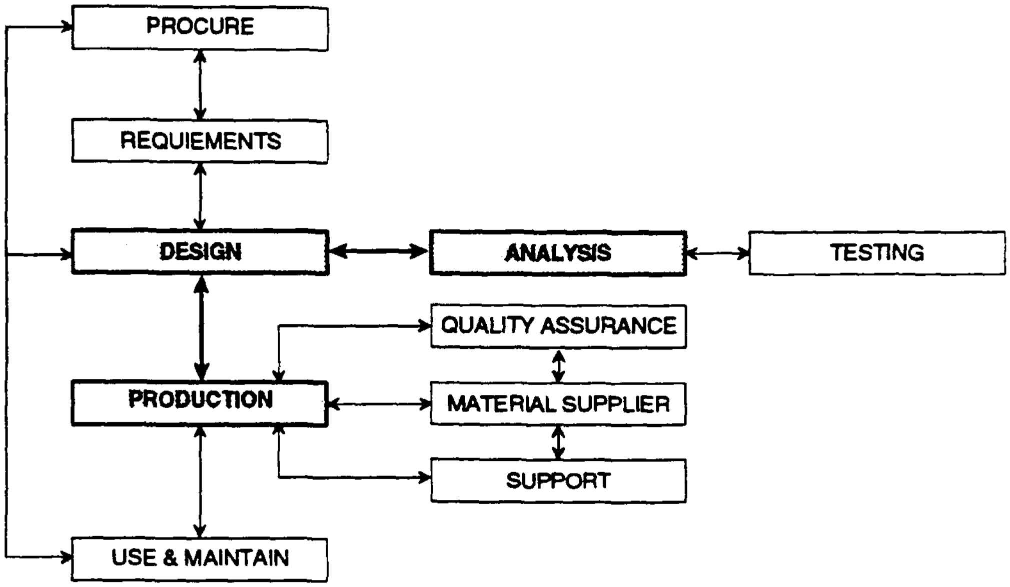


Figure 1 PAS-C Information Flow Diagram

and the arrows show the information transfers required. The bold boxes and arrow graphically define the scope of this document and the application protocols that will be developed in later phases.

1.4 PAS-C Overview

The PAS-C Program addresses two critical national technologies - composites and product data exchange tools. Each of these are emerging technologies in a dynamic environment. Not only are there fast paced technical changes, but there are also frequent changes in the organizations involved in formulating the technology. A set of approaches that will maximize the success of the PAS-C Program and minimize the risks associated with the changes that are on going in both the technology and the environment are an integral part of the PAS-C Team's approach.

The awareness of the current PDES/STEP and composites environments and the ability to function effectively within those environments is critical to the success of the PAS-C Program. Composite information contains unique requirements, with both detail and assembly, and with material and process information closely intertwined. The complexity and volume of product data associated with a composite part can be much greater than other types of parts.

The PAS-C team has structured a unique technical approach for developing an Application Protocol Suite (AS) for composites. This FW/BB methodology is designed to include the integratibility, extensibility and nesting of Application Protocols (APs). The Building-Blocks shown in Figure 2 can be reused on multiple APs. This methodology, after validation on PAS-C, will then be a proven technique to implement Application Protocol Suites.

The approach to be used in conducting the PAS-C Program is designed to maximize the consensus within the communities (composites, standards, software applications and government) with regard to the following PAS-C products: Needs Analysis, PDES SOTA Assessment, PDES

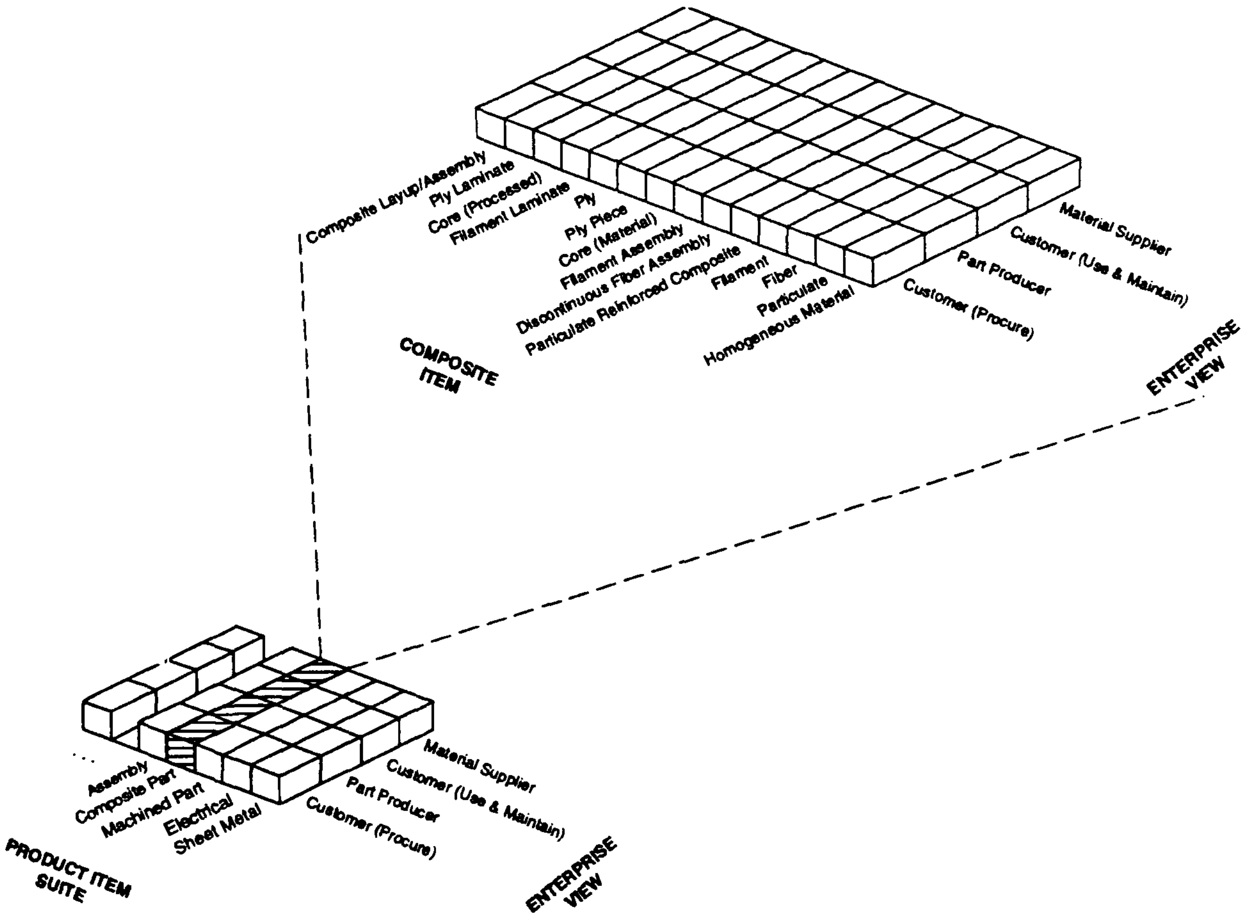


Figure 2 Framework/Building-Block Structure for Composites Application Protocol Suite

voids, AS Development Strategies, AS Test and Demonstration Criteria, ARMs and AIMs. Achieving a consensus in these areas is important to the approach. An integrated set of activities is being utilized to achieve the greatest consensus possible in the least amount of time. A goal is that PAS-C will stimulate vendors to develop a set of software applications that will be used

by the composites manufacturers. Several of the most important activities in the approach are described briefly:

- Composites Committee and other IPO/ISO committees to review and approve the SOTA, AAMs, ARMs, and AIMs,
- The FW/BB methodology for developing Needs Analysis and models,
- Industry Review Board and Vendor Implementation Group participation in developing the priority of voids, AS Strategy, Test and Demonstration Criteria and the demonstrations,
- Design of a risk management strategy based on consensus building among the industry, vendor, government and standards communities,
- Technology transfer centered on achieving concurrence with and ownership of the AS results of the program throughout all communities.

The Air Logistics Centers (ALCs) are being encouraged to participate at the onset of the program. Through the Vendor Implementation Group (VIG), vendors will understand the business case and be encouraged to develop commercial tools. The Industry Review Board (IRB) provides a forum for the Air Force, industry, and the PDES community to review the progress of the PAS-C Program and provide guidance.

The PAS-C Program proposed schedule consists of completing the PAS-C Program within 52 months and is divided into three phases. Air Force approval is required before commencing effort on each subsequent phase. This schedule contains a 12 month duration for Phase I, a 24 month duration for Phase II, and a 12 month duration for Phase III. This is followed by a 4 month period for conducting the Industry/Government Debriefing and final report preparation and review.

Figure 3 provides the overall program roadmap. Output from each Phase provides the needed input to the next successive Phase. The results of the Needs Analysis tasks performed in Phase I form the basis for developing the Application Protocol Suite. Three Application Protocols are anticipated for the AS. Phase II reflects the proposed development of the ARM, AIM, and Testing Criteria for each of these Application Protocols. Included in Phase II is sufficient time to perform a test-fix-test cycle on the AS prior to demonstration. Phase III will use the AS developed in Phase II for the demonstration.

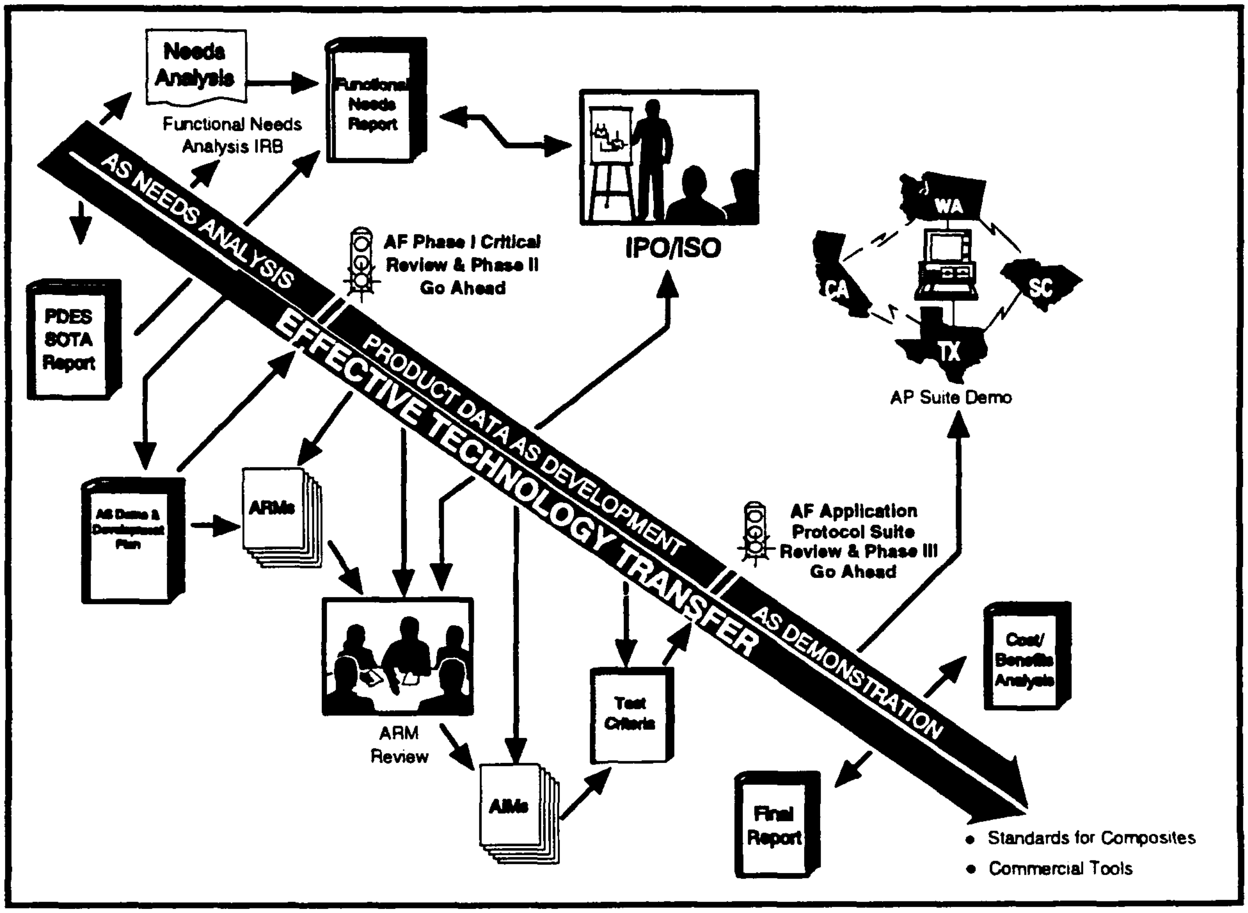


Figure 3 PAS-C Program Roadmap

2 METHODOLOGY

2.1 Overall Methodology

The needs analysis was performed utilizing the IDEF0 structured modeling technique. The technique was focused using the Framework/Building-Block (FW/BB) Methodology. The FW/BB Methodology directs the needs analysis in terms of making the information structured for the follow-on activities leading to the next phase, Application Protocol Development. The following two sections review the FW/BB Methodology, and present definitions of terms required to complete and understand the needs analysis.

2.1.1 Methodology Overview

The methodology used to perform the needs analysis is built around a FW/BB structure. The FW/BB Methodology's primary goal is to organize the collected knowledge into digestible and integratible pieces. A generic overview of this methodology is found in Appendix A. The methodology that was used to perform this composite needs analysis can be summarized by the following tasks:

<u>Needs Identification Tasks</u>

(1) Standardize physical components (composite items)
(2) Determine composite part families and priorities
(3) Select example part set
(4) Establish functional views
(5) Determine functional activities within each view

<u>Needs Analysis Tasks</u>

(6) Determine which functional activities correspond to a composite item across its life-cycle
(7) Determine for each Building-Block its corresponding functional activities
(8) Build IDEF0 models for each potential in-scope Building Block
(9) Determine characteristics and their aspects (from IDEF0 ICOMs)
(10) Determine relationships among characteristics and their aspects
(11) Identify potential "Units of Functionality" (UoF)
(12) Collect initial percent time and cost data for performing as-is activities

The results of the needs identification tasks are addressed in the Functional Needs Report for the PAS-C Program (Doc. No: PASC002.01.00). Only information which was modified is presented again in this report. The results of the needs analysis tasks are discussed in section 2 of this

document as follows: Task 6 in section 2.2, tasks 7 & 8 in section 2.3, task 9 in section 2.4. Tasks 10, 11 and 12 will be completed in later phases of this program.

There are several unique features of this methodology that make it more suited to developing application protocols. These unique features are as follows:

- Establish a standardized set of composite items and terminology
- Identify the functional activities at a low enough level of detail to permit specific informational elements to be captured directly from the composite experts
- Integrate these informational elements across multiple functional views/disciplines

Using the FW/BB Methodology to establish the AS scope makes it directly applicable to scoping each AP within the AS. The FW/BB Methodology identifies known relationships between AP's. Also it organizes the first step of AP development which is defining need. The FW/BB Methodology has also established a firm informational foundation for the later tasks of AP development.

The standardization of terms covered in this document ensures that all information requirements gathered will be consistent and understandable. Establishing a standard set of functional views allows for the information requirements to be understood and managed in a common framework with a mappable relationship to different companies functional views. The division of individual functional views, by composite items, creates easily defined boundaries between the information needs, establishing individual Building-Blocks. These Building-Blocks will lead to defining PDES/STEP integration Units-of-Functionality (UoF).

Within each Building-Block the definitions of the characteristics and their informational aspects plays an important role in the organizing/capturing of a complete meaning of the data. The detail data definition achieved through utilizing a structured approach, such as FW/BB Methodology, will lead to the Application Reference Model (ARM). Not only will following this methodology help to make this model complete and unambiguous, it will also enable the later PDES/STEP integration process. This methodology facilitates the ARM being developed in a framework independent of the PDES/STEP resource models but structured such that the information can be mapped to existing PDES/STEP resources.

2.1.2 Terminology

The real cornerstone of any methodology is a common set of well defined and accepted terminology. The goal is not to generate new or change existing terminology, but to develop a standard set of terminology that can be mapped to and from different industries, companies, and functional disciplines/views.

The information exchange required to develop national or international standards demands that terminology be well defined and accepted so that a reliable information exchange is possible. Sources of terminology used in this document are the ASTM Standard Terminology for Advanced

Composite Materials [7], ISO Carbon Fibre (Appendix B), and the Engineered Materials Handbook [8]. The terminology presented here is a combination of terminology from these sources. Any differences in these definitions will be submitted as a issue against the proposed ISO and ASTM standards. The terminology presented here is limited to those terms required to define needs in terms of FW/BB Methodology.

The following sections contain definitions for General/Composite Item Terminology which defines how a composite part/assembly is categorized in the part view (axis) of the FW/BB Methodology; FW/BB Terminology which covers those terms needed to understand the methodology used in the needs analysis; and Functional View Terminology which explains the other dimension to a Building Block.

2.1.2.1 General/Composite Item Terminology

This section contains definitions for general terms that are utilized throughout this document and definitions for all of the Composite Items. The general relationships between composite items are presented in Figure 4. The center of the figure depicts the four major physical stages of a

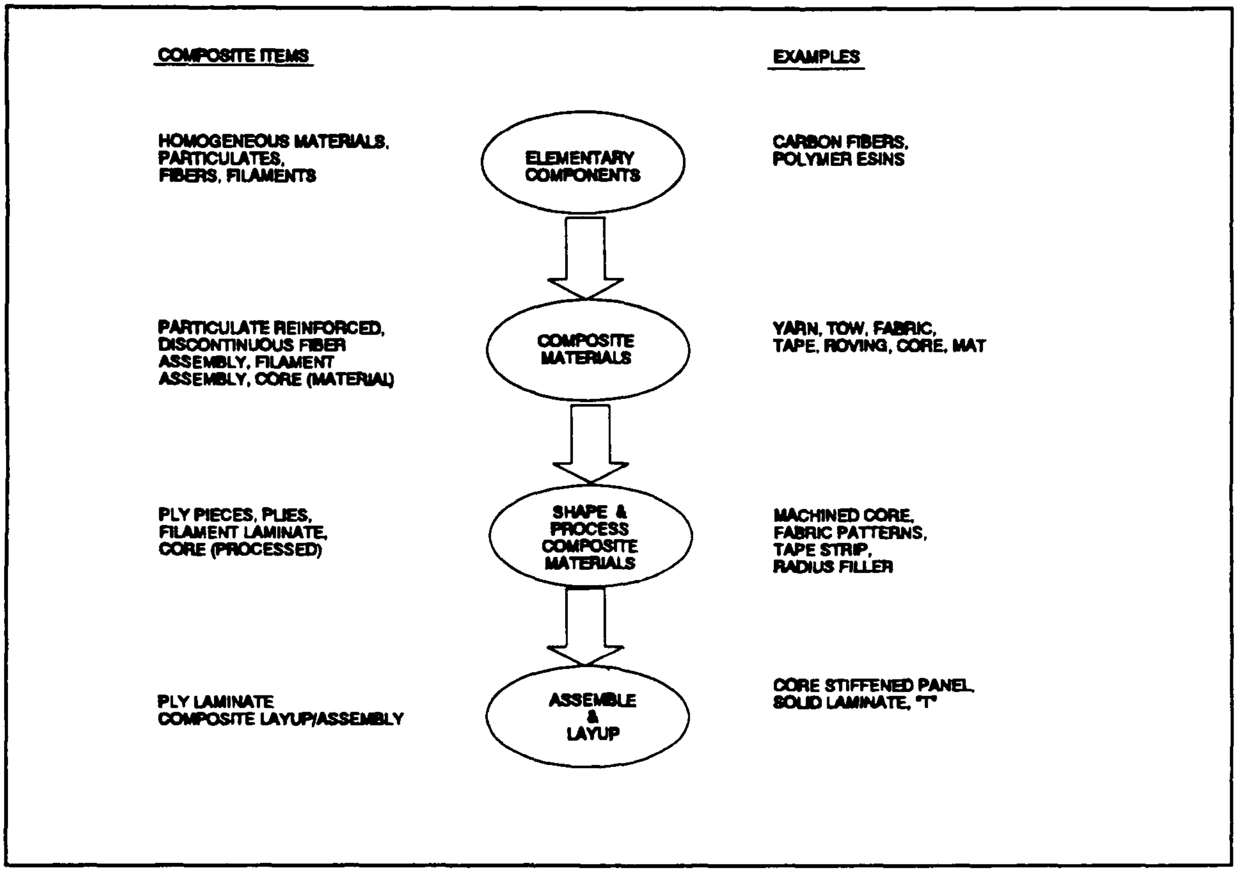


Figure 4 - Composite Items General Relationships

composite part. To the left are the composite items defined here and on the right are examples of these items. The following are definitions and general terms:

Bundle - A general term for a collection of essentially parallel filaments usually without twist.

Composite Layup/Assembly - A physical or conceived assembly which is made of multiple materials that are bonded (versus mechanically fastened) together. A composite layup assembly does not have to stand as a rigid shape without support (tooling) at completion. The composite layup/assembly can be made up of any combination of material and/or other composite layup/assemblies that are potentially going to be combined or bonded with other composite layup/assemblies and material. Some composite layup/assemblies could be used as a composite part but do not have to be. A composite layup/assembly can be any combination of the following: another composite layup/assembly (cured or not cured), filament laminate, ply(ies), core, filament assembly, and homogeneous material (e.g. adhesive)

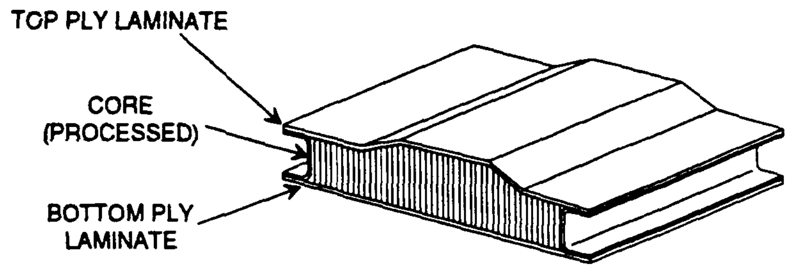


Figure 5 Example of a Composite Layup/Assembly

Composite Material - A material created from a reinforcement (e.g., fiber, particulate, or filament) and an appropriate matrix material (e.g., resin) in order to maximize specific performance characteristics. The constituents do not dissolve or merge completely but retain their identities as they act in concert. Examples of composite materials include tape, fabric (woven, non-woven), mat, yarn, roving, and tow.

Composite Part - A physical part or conceived part that is made of multiple materials which are bonded (versus mechanical fastened) together. A composite part can be mechanically fastened together with other parts which means it must have a rigid shape at completion. To achieve this rigid shape a chemical reaction takes place usually in the presence of heat and pressure. The composite parts chosen for this project are a flat core stiffened panel, a 'T' shaped stiffener, and a solid laminate panel.

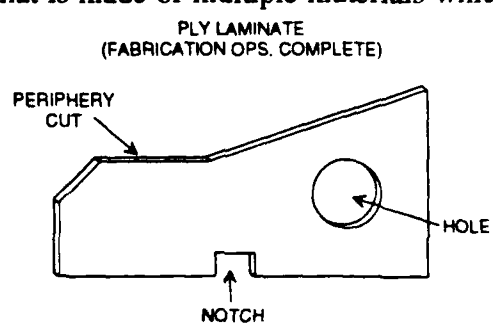


Figure 6 Example of Composite Part

Core (Material) - A material in its initial form, usually in the sheets, that is produced and serves as a core material in sandwich construction of ACSPs. Most common example is various forms of honeycombs which are a resin impregnated material manufactured in, usually, hexagonal cells. Honeycomb may also be metallic or polymer material in a rigid open cell structure.

Core (Processed) - The central component of a sandwich construction to which the faces or skins are attached. Core material that has been machined, formed and bonded together. Core can have a potting compound or adhesive applied to make it more rigid and/or provide solid attachment points.

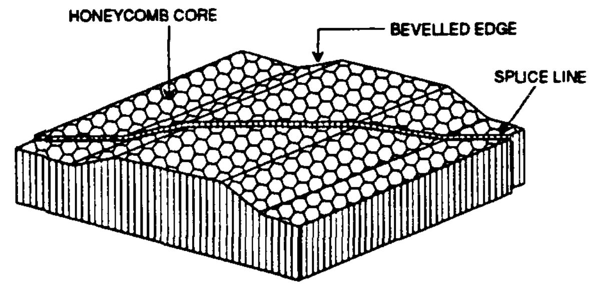


Figure 7 Example of Core (Processed)

Discontinuous Fiber Assembly - A collection of short fibers suspended in a homogenous material (matrix). Usually the length of the fibers are relatively the same within a detail. The orientation of the fibers are usually random. Examples include fiberglass chop.

Fiber - A single homogeneous strand of material (essentially one dimensional in the macro-behavior sense) used as a principal constituent in advanced composites because of its high axial strength and modules.

Filament Assembly - A collection of yarns or tows combined together in some manner and frequently accompanied by a joining homogenous material (matrix). Examples include woven and non-woven fabric, individual tows, yarns, and roving.

Filament - Individual fibers of indefinite length used in tows, yarns, or roving.

Filament Laminate - Product made by bonding together two or more bundles of a material or materials of filament construction (e.g., tow, yarn, roving). Examples include pultruded shapes and radius fillers.

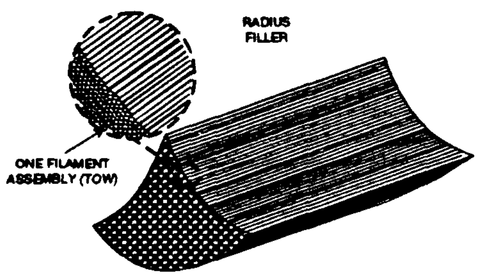


Figure 8 Example of Filament Laminate

Homogenous Material - A material made up of a single structure (no reinforcements). Examples include resins, stabilizers (a filler or coating used to make core more rigid), foaming and film adhesives, and phenolic blocks.

Ply Laminate - Two or more plies that mate with one another. The plies have unique orientation and shape within the ply laminate.

Matrix - A material in which the reinforcement of a composite is imbedded; it can be plastic, metal, ceramic, or glass.

Particulate Reinforced Composite - A collection of particulates suspended in a homogenous material (matrix).

Particulate - Small pieces of material which are basically symmetric in shape. The size of a particulate is relative to the size of the homogenous material (matrix) it is suspended in.

Ply - One of the layers of composite material that make up a stack or laminate which results in a contiguous structure with a definable boundary. Also a single pass in filament winding. Ply pieces which comprise a ply must be of the same material and fiber orientation.

Ply Piece - A single segment of a ply which may be spliced with other ply pieces on the same layer to make up a ply.

Reinforcement - A material added to the matrix to provide the required properties: ranges from short fibers through complex textile forms.

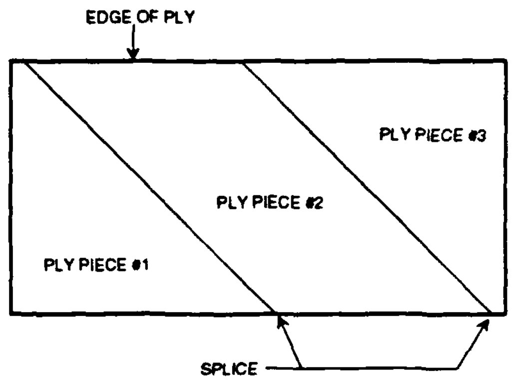


Figure 9 Example of Ply & Ply Piece

Resin - A material, generally a polymer, that has an indefinite and often high molecular weight and a softening or melting range and exhibits a tendency to flow when it is subjected to stress. Resins are used as the matrices to bind together material in composites.

Short Fiber - Noncontinuous fibers relative to the total size of the homogenous material (matrix) they are suspended in.

Tow - A continuous group of fibers which are sometimes impregnated with a resin type of homogenous material.

2.1.2.2 FW/BB Terminology

This section covers terms that are utilized throughout the FW/BB Methodology. In general these terms have broad meanings or can be interpreted in many ways. Appendix A contains a description with diagrams as to how this terminology interrelates. For this document they will be scoped as follows:

Composite Item - Composite Items are a set of fundamental physical components that make up a composite part. A composite item can be as basic as a fiber or as complex as a composite layup/assembly. The key is that composite items can be combined to form all the possible combinations of composite parts.

Functional Views - Represent the life cycle set of application groups required to define, build, and support a composite part. The groups' bounds are established based on traditional company organizations.

Composite Item Characteristic - A unique arrangement of informational aspects that characterize a particular composite item within a particular functional view. A Composite Item Characteristic can be valid for more than one functional view.

Informational Aspect - A piece of information about such things as function, material, shape or process. Aspects are combined and constrained to make up unique characteristics describing such things as plies, ply laminate, composite layup/assemblies, core, etc.

Function - Defines the role a composite item characteristic performs (e.g., load carrying, connector, separator). It is a type of informational aspect.

Material - Defines the physical properties of the composite item characteristic as it relates to its chemical makeup. It is a type of informational aspect.

Shape - Defines the form of the composite item characteristic. This also includes all the different ways a shape can be represented and presented. It is a type of informational aspect.

Process - This defines the mechanism for which a material is converted from its initial shape to form the desired composite item characteristic shape that performs a particular function. This includes processes such as assembly, material removal, material deformation, and state changes. It is a type of informational aspect.

2.1.2.3 Functional View Terminology

This section defines an initial set of life-cycle application views. These views were established by determining the product life-cycle applications and dividing them into groups. These views can be as general or specific as necessary in order to communicate with various composite experts. Most experts come from particular disciplines such as analysis, design, manufacturing, engineering, etc. Thus, this initial set of views was established based on traditional company organizations that the experts will recognize. Within each organizational view, smaller detailed views can be created to facilitate the knowledge gathering process. Building activity node trees and IDEF0 models will facilitate the documentation of the informational needs within these views.

Customer (Procurement Process)

Customer Procurement - Define performance criteria of overall deliverable. Verify product met deliverable requirements.

Customer Needs - Determine the required functionality of the system or systems.

Conceptual Design - Preliminary concepts are developed describing the general characteristics and desirable attributes for the system or systems.

Requirements Analysis - Determine which of the identified needs are actual requirements.

Part Producer

Requirements

Conceptual Design - Convert performance criteria into functional requirements. Determine which parts will be composites. Determine overall configuration and relationships between parts.

Requirements Analysis - Analyze the requirements that have been defined for the system or systems and verify the validity and impact of those requirements.

Materials & Processes - Develop and verify new materials and production materials. include verification that all required design requirements are met.

Analysis

Preliminary Structural Analysis - Analyze and optimize the conceptual design components so that they meet functional requirements. Analysis consists of static loads, thermal, dynamic, mass properties, static stress, and durability/damage tolerance analyses.

Detail Structural Analysis - Analyze and optimize the detail design so that the design meets all functional requirements. Analysis consists of static loads, thermal, dynamic, mass properties, static stress, and durability/damage tolerance analyses.

Structural Analysis Prod. Support - Resolve any problems encountered during production relating to the structural integrity of any composite parts that require repair/rework.

Design

Structural Design - Transform analytical and descriptive information about the part into an unambiguous definition of the part supporting detail physical makeup, part interfaces, and specifications.

Preliminary Structural Design - Prepare preliminary design of the composite parts based upon initial definition of the performance requirements.

Detail Structural Design - Complete all design drawings, Bill of Materials, allowables, etc for composite parts based upon finalized design requirements.

Structural Design Prod. Support - Resolve any problems encountered during production relating to the design of the composite parts.

Configuration Management - Maintain configuration control over product definition and product data versions.

Testing

Material Properties Testing - Verify that the properties of raw materials and cured composites meet or exceed all functional requirements.

Structural Testing - Verify that the cured structure meets or exceeds all design requirements.

Environmental Testing - Verify that the part will perform within acceptable parameters when operating in the desired environment.

Production

Manufacturing Planning - Determine overall MFG build or buy scenario. Determine MFG ENG's and QA's PD (Product Data) generation tasks. Identify all required ENG PDD (Product Definition Data) to perform MFG PD generation tasks.

Manufacturing Process Planning - Determine Process steps for fabrication of part. Identify what tools are required per fabrication step. Coordinate and Incorporate PD generated by other groups into planning package.

Tool Design - Design tools based on fabrication process Lay-up, handling, curing, assembly. Design tools that build production tools.

Tool Fabrication - The production of the tooling needing to produce composite parts. for example, bond molds, core locating templates, assembly tools, and NC programs.

Tool Liaison - Personnel that resolve any problems encountered using the tooling associated with the production os composite parts. Also promote communication between the shop and the other tooling functions.

Numerical Control Programming - Generate PD required to support automated shop floor processes; ATLM, RPCM, Part Trimming, Ultrasonic. Machining bond mold surfaces, material handling devises.

Part Fabrication - The activities associated with the actual production of the composite parts. these include tool preparation, layup & assembly, curing, trim & drill, and non-destructive inspection.

Quality Assurance

Quality Assurance (QA) - Identify and determine all inspection steps and QA processes required to produce and maintain composite parts and support tooling. Develop Inspection Plans for Incoming Material, Fabrication Methods, Curing, Post Cure. Documents all suspected anomaly data and determines cause, effect, and corrective action.

Support

Manufacturing Process Development - Develop new methods to produce composite parts more efficiently and economically while meeting or exceeding all design requirements.

Logistics - Develop maintenance and repair manuals.

Material - Buy and insure incoming material quality.

Customer (Use and Maintain)

Customer Maintenance - Perform scheduled upkeep and testing on composite components.

Customer Repair - Define and perform repair on existing composite components.

Customer Redesign - Conceive, develop, and fabricate a replacement part which could be based on updated requirements.

Customer Reproduce - Build a composite part based on an existing product definition.

Materiel Supplier

Materiel Supplier - Produce and test composite material per user's and/or supplier's specifications.

2.2 Scope of Needs Analysis

The needs analysis defines the product data required to design, analyze, test, produce, and assure the quality of the product class typified by composite airframe structural components. Thus the scope of this needs analysis is that of the part producer in Framework/Building-Block Methodology. This needs analysis does not address the customer requirements of procurement, use, and maintenance of composite parts. It also does not directly address the manufacture of composite materials such as fibers, fabrics, and tows.

Three part families were selected. Those activities relating to these part families have been used to define the scope. The building blocks which correspond to those activities were then identified. The following three sections contain detail information about the part families, their associated functional activities, and the corresponding building blocks.

2.2.1 Part Families

Three unique aircraft composite structural components were identified to limit the scope of this program. Analysis of these three part families defined the composite items and their sub-types that are in scope. Thus the selection of part type defines the first dimension of scope, composite items.

Special consideration was given to part types which are presently utilized in industry, more specifically those utilized in modern aircraft. These part types are called Aircraft Composite Structural Parts (ACSP) in this document. Most ACSP's are high-performance continuous fiber with organic matrix material. Fiber types most common are carbon, fiberglass, and aramid. By far the most used organic matrix is some blend of epoxy resins. Another parameter of the part type is the complexity of the assembly, or in FW/BB terminology, how many and what types of composite items are contained in each part. A good overview of aircraft applications up to 1986, of composites is presented by Jeane Anglin in reference [8] and by Frank Traceski in reference [9]. These references also present pictorial representations of the more complex parts.

The three part families were selected by utilizing a QFD House of Quality matrix. This technique compares the type of parts presently being produced in the composite facilities of PAS-C team member companies against program requirements. The first criteria group for prioritizing the set of part families is as follows:

- Significant numbers in all types of Aircraft
- Significant numbers in DoD fleet
- Air Force has example part within part family
- Good for determining scope with well defined bounds

Example parts from different airplane programs were collected and compared against a second set of criteria using the QFD House of Quality matrix. The list of criteria is as follows:

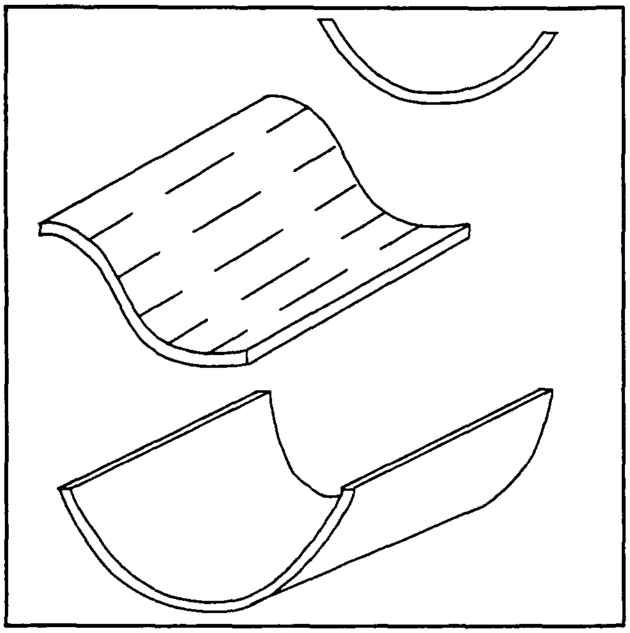
- Is the Example Part a Secondary Structure/ Load carrying member?
- Is the Example Part in the DoD Operational fleet?
- Is the History of use in the fleet representative of life-cycle views which is readily available for Cost Benefit Analysis (CBA)?
- Is the Product Data Releasable data?
- Does it cover most of the part family aspects it is to represent?
- Is the part recognizable by the experts that will be interviewed?
- Is the part simple yet comprehensive enough for an effective demonstration?
- Is the part data in a digital format that will aid in the population of a PDES/STEP data base?

Based on evaluating the QFD matrix, the following three composite part families were selected as prime areas for sample part selection:

- Contour skin laminate - general contour
- Core stiffened panel
- "T" composite assembly

The three example parts can be found in PAS-C Document number PASC003.01.00, PAS-C Sample Part Set. The recommended parts, two F-16 parts and one B-2 part, were selected from the three part families. Figures 10 - 12 describe these example parts.

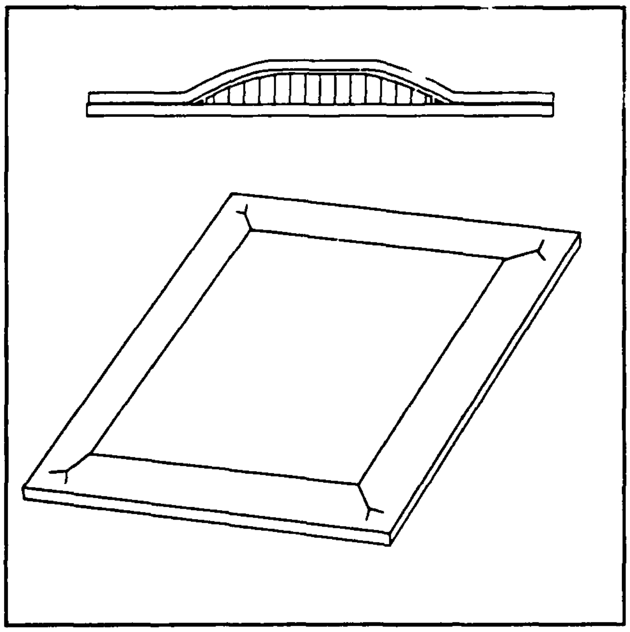
Figure 10 - Contoured Skin Laminate (CSL) - Ply Laminate General



A general (CSL - contour/wrappable) has a surface that can be physically unwrapped to a flat pattern and preserve its surface area. One example of this type of surface is a ruled surface.

Contains the following composite items
Plies
Ply Pieces
Filament Assemblies
(woven fabric)
(tape)
Discontinuous Fiber Assembly
(mat)

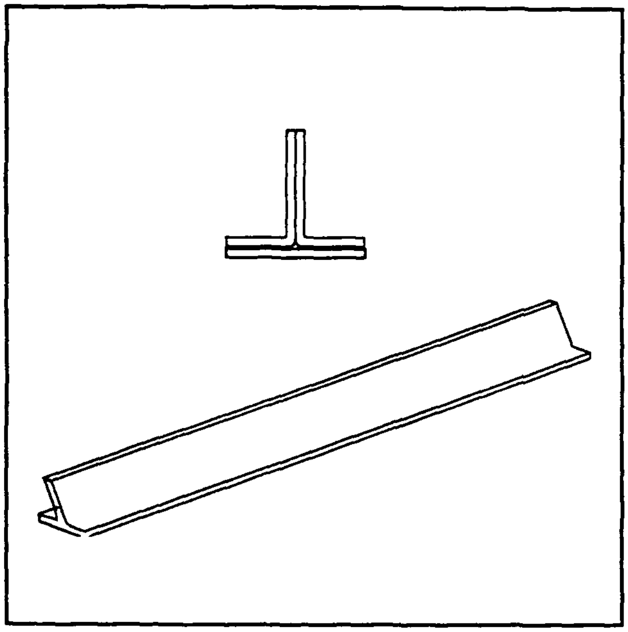
Figure 11 Core Stiffened Panel (CSP) - Composite Layup/Assembly - Stiffened Panel (Core)



A panel with one or more pieces of core sandwiched between two general ply laminates.

Contains the following composite items
Core (materiel)
Core (processed)
(potted)
(stabilized)
(machined)
Ply Laminate (2) Generals
Plies
Ply Pieces
Filament Assemblies
(woven fabric) and/or (tape)
Homogenous Material
(stabilizer)
(adhesive)
(potting compound)

Figure 12 - "T" - Composite Assembly (TCA)
Composite Layup/Assembly - "T" Section



An assembly of two angles and one cap. The two angles are placed back to back. The cap lies on two legs, one from each angle.

<u>Contains the following composite items</u>
Ply Laminate
    (2) angles and cap or (2) angles
Plies
Ply Pieces
Filament Assemblies
    (woven fabric) and/or
    (tape)
Filament Laminate
    (radius filler)

The general (contour/wrappable) laminate detail is the simplest in terms of the composite items with which it is constructed. The stiffened panel (core) part contains core (processed) between two ply laminates. The "T" Composite Layup/Assembly is made up of three ply laminates, two of which are angles and a cap. Filling the intersection between the three ply laminates will require a filament laminate used as a radius filler. Both the "T" Composite Layup/Assembly and the Stiffened Panel (core) may use an adhesive (a homogeneous material) to bond various composite items together.

The FW/BB structure defined earlier in, Figure 2 showed the product item suites of higher level part types such as machined part, sheet metal, and composite part. Figure 2 also shows the expansion of composite part into its composite items. This establishes a complete breakdown of composite items which must be available to understand and capture the information requirements for a composite part. Figure 13 shows a second expansion of composite items into the detail composite items contained in these sample parts. Thus ? shows the scope of the needs analysis in this first dimension of scope, composite items.

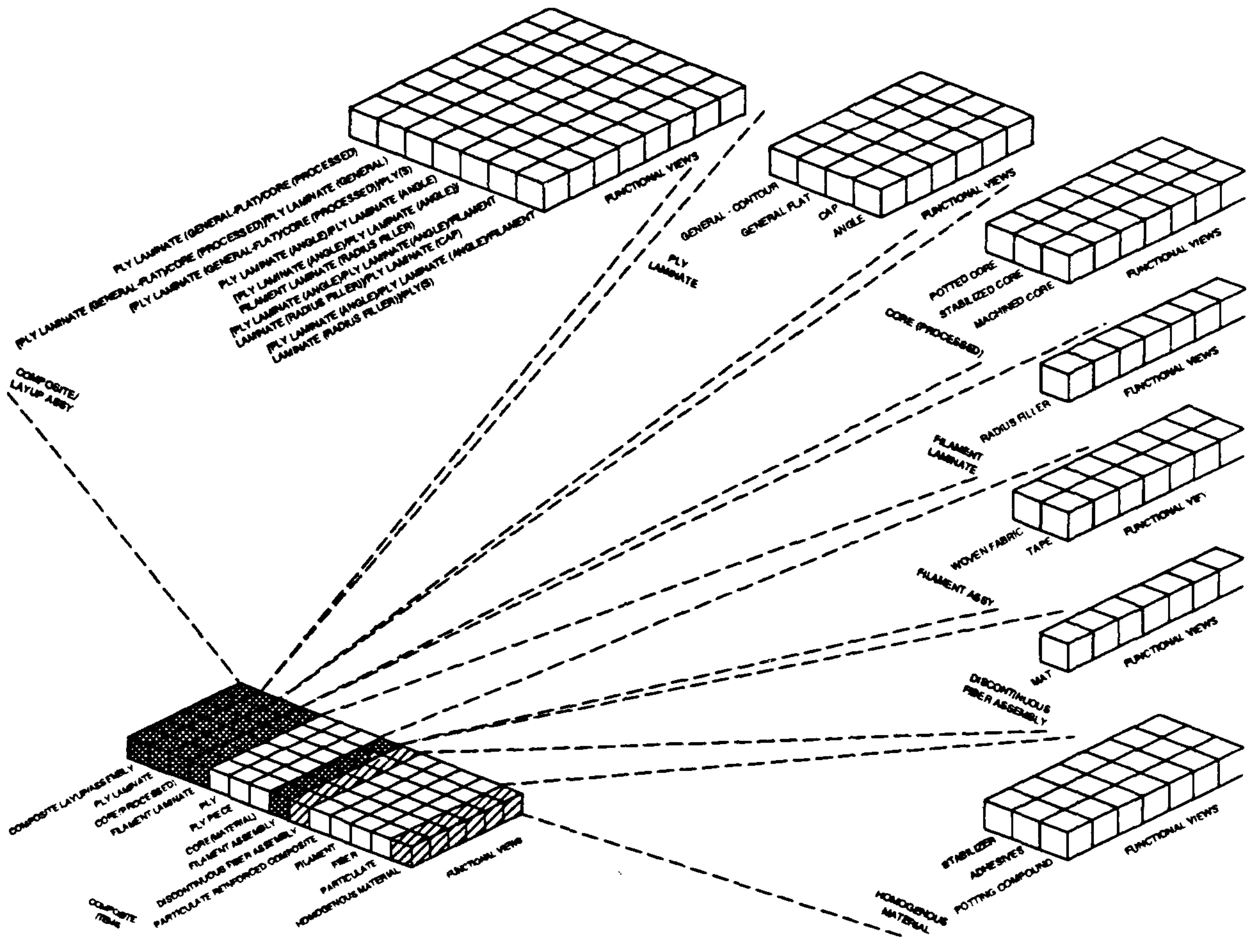


Figure 13 FW/BB Expansion of Individual Composite Items

2.2.2 Functional Activities

The second dimension of scope is that of functional activities. The functional activities that are in scope are those to design, analyze, and build a composite part.

The FW/BB Methodology includes expansion of the enterprise view into more detail level functional views as shown in figures 14 and 15. Figure 14 shows the first level of expansion from each enterprise view to the functions existing within each enterprise. Figure 15 continues to refine scope by showing the expansion of the design analysis, and production views within the Part Producer Enterprise View.

The top level activity node tree for a general ASCP is shown in Figure 16. The top level nodes A1-A4 correspond to the four enterprise views in FW/BB diagram figure 14. The other activities can be mapped to the appropriate FW/BB functional view. This mapping is shown in Table 1.

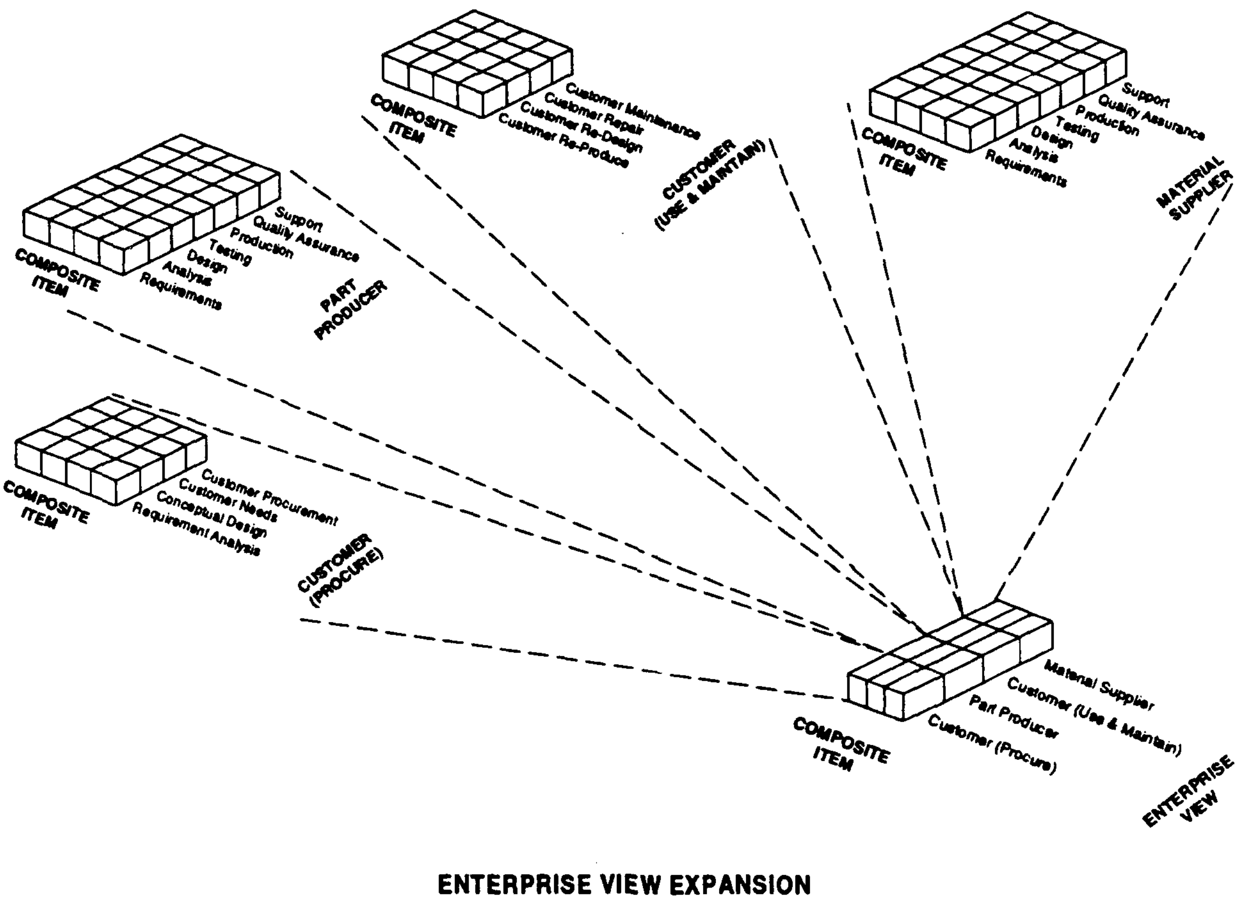


Figure 14 Enterprise View Expansion

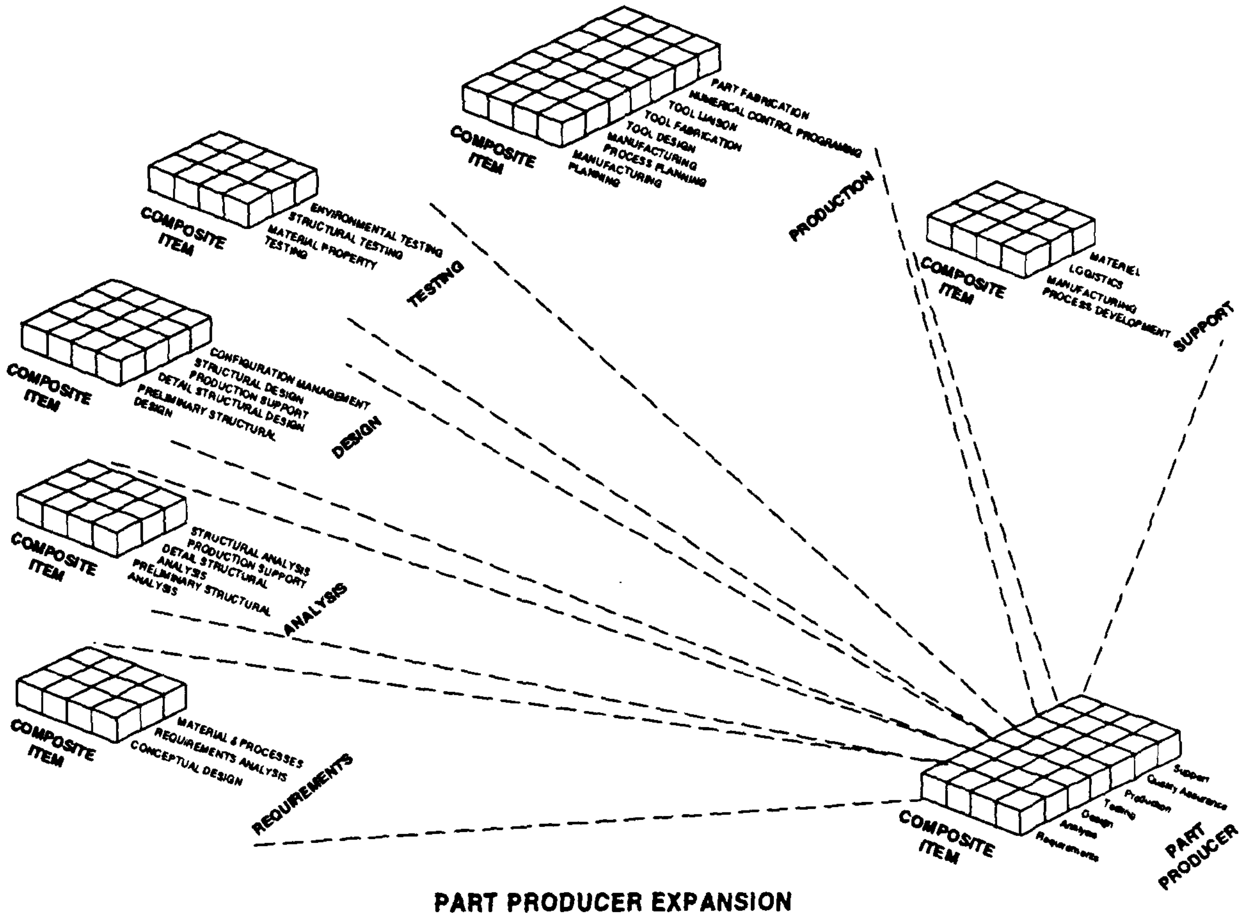


Figure 15 Part Producer Expansion

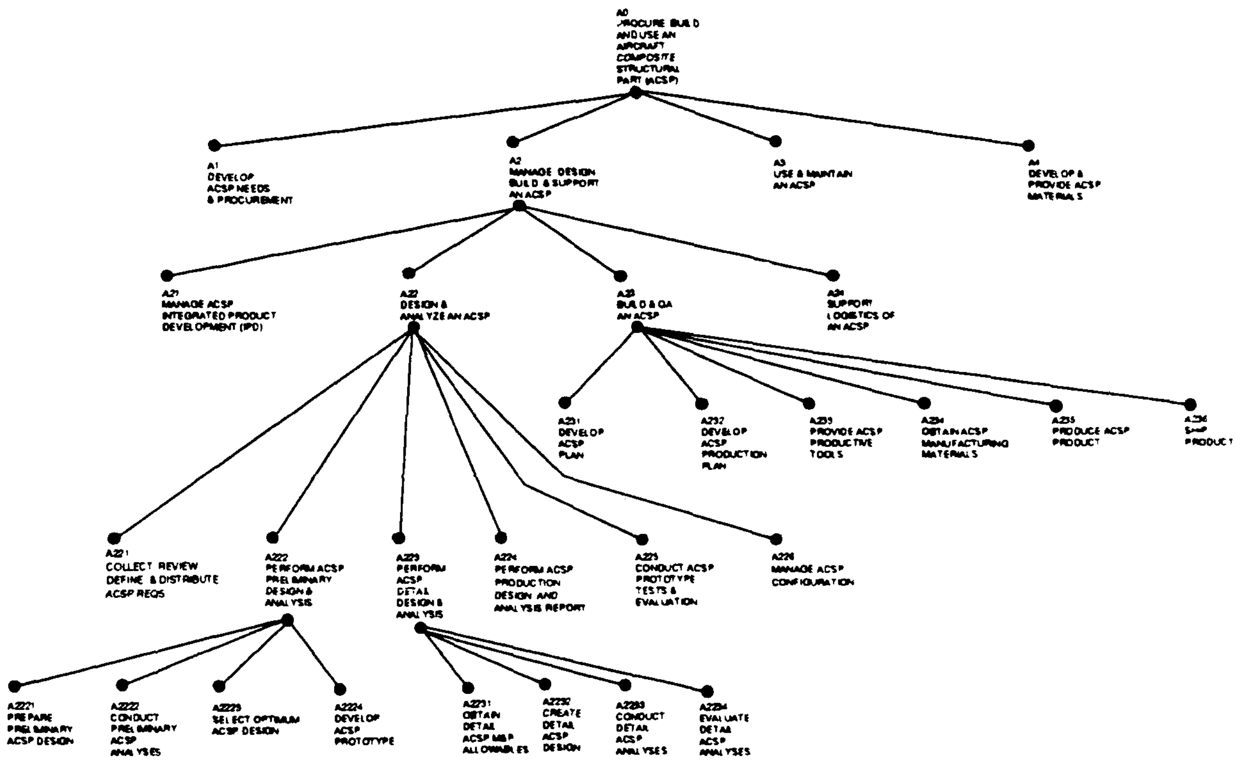


Figure 16 Top Level Node Tree

The needs analysis was scoped to those activities under A2 Manage, Design, Build, & Support an ACSP. The node tree shows the expansion under this node. This corresponds to the enterprise view of part producer. The scope of all activities under A2 was reduced further to meet program goals that deal with product data.

The activities under node A21 Manage ACSP Integrated Product Development and Build do not create product definition data. In most cases their use of product data is only to consider it as information for making management decisions or establishing schedules. Thus no activities under this node were considered.

The node A24 Support Logistics of an ACSP is an important node for defining the interface to Customer (Use & Maintain). Since logistic experts were not allocated time to this project, there is only limited information in this area. Nevertheless, the functional activities that have been addressed in this report will satisfy many of the Air Logistic Centers composite structure support needs for product definition data.

The product data created in nodes A235 Produce ACSP Product is a subset of product data which is not covered by existing PDES/STEP resources. This node includes the activity, Assure ACSP Product Quality, which is a major user and creator of data. Portions of this area are being considered by other efforts outside this project and are not investigated further here. Also, the product data created in Node A235 is dependent on the product data created in the above-shop-floor activities that were in scope and therefore had to be lower priority. Thus the product data created from build activities is not in scope.

Table 1 FW/BB Mapping

FUNCTIONAL VIEWS	NODE NUMBERS
CUSTOMER (PROCURE)	
Customer Procurement	A1
Customer Needs	A1
Conceptual Design	A1
Requirement Analysis	A1
PART PRODUCER	
Requirements	
Conceptual Design	A221
Requirement Analysis	A221
Material & Processes	A2231,A2315,A22112,A222212,A2315
Analysis	
Preliminary Structural Analysis	A2222
Detail Structural Analysis	A2223
Structural Analysis Production Support	A22422,A22452
Design	
Preliminary Structural Design	A2221
Detail Structural Design	A2232
Structural Design Production Support	A22421,A22451
Configuration Management	A226
Testing	
Material Property Testing	A2231,A23621
Structural Testing	A225
Environmental Testing	A225
Production	
Manufacturing Planning	A231
Manufacturing Process Planning	A232
Tool Design	A2331
Tool Fabrication	A2333
Tool Liaison	A2334
Numerical Control Programming	A2332
Part Fabrication	A235
Quality Assurance	
Quality Assurance	A236
Support	
Manufacturing Process Development	A2321
Logistics	A24
Material	A214,A234
CUSTOMER (USE and MAINTAIN)	
Customer Maintenance	A3
Customer Repair	A3
Customer Re-Design	A3
Customer Re-Produce	A3
MATERIEL SUPPLIER	
Materiel Supplier	A4

2.2.3 Building-Blocks

The Building-Blocks help to communicate scope by graphically showing which composite items and associated functional views were analyzed for their informational needs. The in-scope composite items were determined based on the selected part families composite item constituents. The in-scope functional views were refined to analysis, design, and production activities because these areas showed the highest level of automation and largest volume of computerized composite part data exchange.

Thus when the needs analysis scope is viewed in terms of the FW/BB Methodology, it is easily visualized in terms of the appropriate blocks of the diagram. Figure 17 presents this scope in a FW/BB diagram of only those Building-Blocks that are in scope. Certain in-scope Building-Blocks might be void, because any particular composite item does not have to be utilized in every functional view. Figure 17 is just representing the overall investigation area of the Needs Analysis. As noted in the previous section, some Building-Blocks are lower priority for this needs analysis and were not analyzed beyond a IDEF0 activity definition.

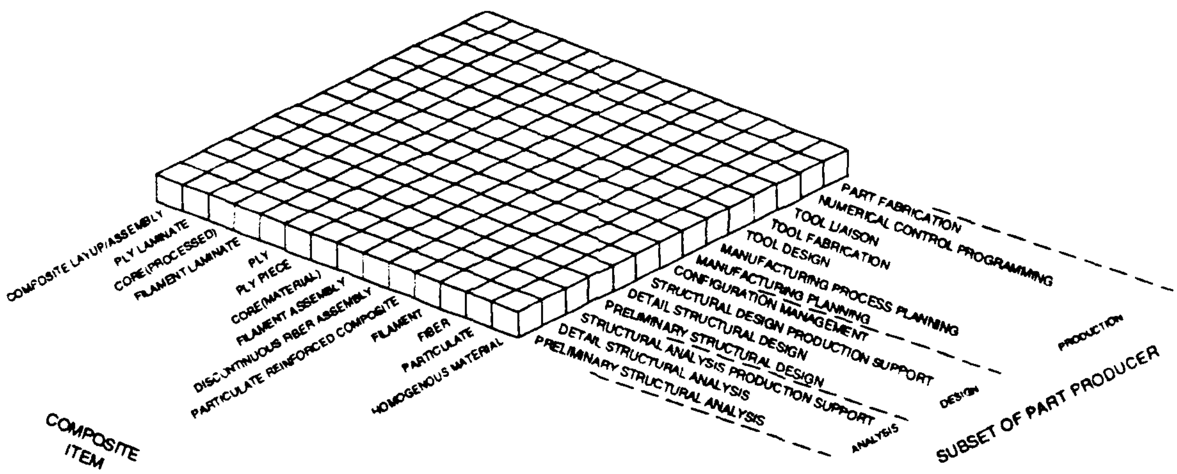


Figure 17 Composite Item versus Part Producer Building Blocks

2.3 Activity Models

2.3.1 Introduction

The activity models built represent different portions of the life-cycle of a typical Aircraft Composite Structural Part (ACSP). These activity models are scoped to support some specific set of Framework/Building-Block (FW/BB). Based on this and other scoping parameters, these activity models will be further refined to support the development of the follow-on phases of PAS-C Program.

These activity (i.e. process, functional) models were built using the standard IDEF0 methodology. These models specify activities and the relationship between activities by showing their respective Inputs, Constraints, Outputs, and Mechanisms (ICOMs). Hierarchical node trees and indentured lists which show the activities, IDEF0 decomposition diagrams and their associated glossary pages make up the activity models.

Interviews were conducted with functional experts in the design, analysis, and build functions of aircraft composite structural parts. In so doing, particular attention was placed on the transfer of information between the functions as viewed by a general aerospace contractor. Boeing, General Dynamics and LTV personnel contributed to a generalized view without compromising the tailored techniques and tools developed for competitive technology strength. The definitions of the activities and their ICOMs were general enough to be applicable to any aerospace contractor working on aircraft composite structures.

Utilizing on the composite item axis of the FW/BB matrix, activities for three part families were selected based on the frequency and complexity of these types of parts in the field. In practice, activities were modeled down to levels that would document information that is transferred to another function. Activities were also decomposed where necessary to show the part specific sensitivity. The detail design and analysis activities were investigated more so than the conceptual, preliminary and production support design and analysis due to the relative amount of information available during this phase in a composite part life-cycle. The completion of this phase is also the major interface to the start of the build cycle. This information also is representative of what is used by the product support function that is internal and external to the aerospace contractor.

2.3.2 General ACSP Node Tree

The life cycle of a typical ACSP is represented in a hierarchical activity node tree which is decomposed down through the three principal functions of Detail Design, Detail Analysis and Build. A General ACSP viewpoint was taken down to a level in the tree where the sensitivity of the type of ACSP is reflected in a part specific node which is attached to the node. The three part families selected from the FW/BB composite item axis are "T" Composite Assemblies (TCA), Contoured Skin Laminate (CSL) and a Core Stiffened Panel (CSP). All of the activities

shown on the node tree were not considered in scope for decomposition with IDEF0 diagrams. Those that were considered are highlighted with a box on the drawing (Appendix D).

A special numbering sequence was developed for all the part specific nodes shown on the general node tree diagram due to the node number length when placed in a typical IDEF0 box, and the drawing layout constraints of the drawing form used. Every part specific node number would change based on the last 2 numbers in the original. An example of this is the node A2222132-0 Define ACSP Structural Configuration would then be changed to A32-0 based on the last two numbers of the original. This A32-0 node then acts as a pointer to the part specific decomposition which exist in accompanying drawings. These particular drawings and activity structures are discussed in section 2.3.5.

Appendix D contains the following drawings: General ACSP M/D/B/S, Design ACSP, Build ACSP, and Preliminary and Detail ACSP Analysis.

The general ACSP node tree diagram (Dwg. # PAS-C-01) is the multi-functional view of the ACSP. Functional node tree diagrams were also built to show the three main Design, Analysis and Build views which were then combined to make the general node tree diagrams. The three trees are:

Preliminary and Detail ACSP Analysis	PAS-C-02	Sheet 1 of 2
Design ACSP	PAS-C-03	Sheet 1 of 2
Build ACSP	PAS-C-04	Sheet 1 of 1

2.3.3 Indentured Activity Lists

The indentured lists have been broken out into four major sections that show the activities hierarchy within each section. The four sections are: General ACSP Activity List, Part Specific Design Activity List, Part Specific Analysis Activity List, and Part Specific Build Activity Listing.

2.3.3.1 General ACSP Activity List

A0 Procure, Build, & Use an Aircraft Composite Structural Part
A1 Develop ACSP Needs & Procurement
A2 Manage, Design, Build, & Support an ACSP
  A21 Manage ACSP Integrated Product Development (IPD)
    A211 Manage ACSP Design Process
    A212 Manage ACSP Build Process
    A213 Manage ACSP Support Process
    A214 Manage ACSP Resources
      A2141 Manage ACSP People Resources
      A2142 Manage ACSP Tool Resources
      A2143 Manage ACSP Facility Resources

A2144 Manage ACSP Time and Cost Budgets
A215 Manage ACSP Integration
A22 Design & Analyze an ACSP
A221 Collect, Review, Define & Distribute ACSP Requirements
A2211 Collect and Review other Engineering ACSP Requirements
A2212 Collect and Review Build and QA ACSP Requirements
A2213 Collect and Review Support Logistics ACSP Requirements
A222 Perform ACSP Preliminary Design and Analysis
A2221 Prepare Preliminary ACSP Design
A22211 Evaluate ACSP Preliminary Loads
A22212 Obtain ACSP M&P Support
A22213 Prepare ACSP Design Concepts
A222131 Select ACSP Geometry System
A222132 Build ACSP Concept Geometry
A2221321 Develop ACSP Structural Concepts
A2221322 Prepare ACSP Candidate Drawings
A2221323 Evaluate ACSP Analysis Results
A2221324 Develop ACSP Trade Study Concepts
A2221325 Select/Detail ACSP Preliminary
A222133 Prepare ACSP Functional Interface Concept Drawings
A222134 Perform ACSP In House PDRS
A2222 Conduct Preliminary ACSP Analysis
A22221 Review ACSP Design Data
A222211 Review ACSP Layouts
A2222111 Review ACSP Geometry
A2222112 Review ACSP Sizes
A2222113 Obtain ACSP Initial Weights and Balances
A222212 Review ACSP Material Selections
A2222121 Select ACSP Composite or Homogeneous Material
A2222122 Screen ACSP Available Materials
A2222123 Collect ACSP Existing Material Data
A2222124 Define ACSP Material Development Program
A2222125 Generate, & Collect/Reduce ACSP Material Test Data
A2222126 Create ACSP Analysis Materials Database
A222213 Conduct ACSP Baseline Analysis
A2222131 Define ACSP Critical Dimensions
A2222132 Define ACSP Structural Configuration
A222214 Conduct ACSP Trade Study Analysis
A2222141 Optimize ACSP Critical Dimensions
A2222142 Optimize ACSP Structural Configuration
A2222143 Support ACSP Design Trades
A22222 Define ACSP Design Criteria
A222221 Review ACSP SOW Specifications
A222222 Select ACSP Environments

A222223 Select ACSP Limits
A22223 Create ACSP Preliminary Analysis Decision Record
A2223 Select Optimum ACSP Design
A2224 Develop ACSP Prototype
A223 Perform ACSP Detail Design & Analysis
A2231 Obtain Detail ACSP Material & Process Allowables
A2232 Create Detail ACSP Design
A22321 Collect Baseline ACSP Design Data
A22322 Build ACSP model/drawing tree
A22323 Prepare ACSP models & drawings
A223231 Select ACSP model/drafting system
A223232 Create ACSP geometry Layouts & Models
A2232321 Receive and Review ACSP Geometry Data
A22323211 Receive and Review ACSP Paper Geometry Data
A22323212 Receive and Verify ACSP CAD Translated Data
A22323213 Receive and Review ACSP Native CAD Data
A2232322 Build ACSP Layouts and Models
A22323221 Select ACSP Construction Plans
A22323222 Create ACSP 2-D Envelope
A22323223 Create ACSP 3-D Wireframe
A22323224 Create ACSP Surface
A22323225 Create ACSP Solid
A2232323 Prepare ACSP Data for Transfer
A223233 Create ACSP Drawing Data
A2232331 Create ACSP tooling interface drawings
A2232332 Prepare Detail ACSP Composite Item Drawings
A22323321 Select ACSP views
A22323322 Prepare ACSP detail views
A223233221 Resolve ACSP interfaces and joints
A223233222 Resolve ACSP size panel issues
A223233223 Create ACSP data
A22323323 Attach ACSP dimensions and tolerances
A22323324 Attach ACSP composites engineering
A22323325 Prepare & coordinate ACSP signature process
A2232333 Prepare & Integrate ACSP assembly drawings
A2232334 Prepare & release ACSP AMRs
A2232335 Prepare ACSP installation drawings
A223234 Update ACSP drawing & model data
A22324 Build ACSP parts list
A22325 Perform ACSP CDR functions
A2233 Conduct Detail ACSP Analysis
A22331 Conduct ACSP Static Loads Analysis
A22332 Conduct ACSP Thermal Analysis
A22333 Conduct ACSP Dynamic Analysis

A22334 Conduct ACSP Mass Properties Analysis
A22335 Conduct ACSP Static Stress Analysis
A223351 Create ACSP Static Stress Analysis Decision Record
A223352 Conduct ACSP Finite Element Analysis (FEA)
A2233521 Generate ACSP Finite Element Models
A22335211 Generate ACSP Node Geometry
A223352111 Hand Generate ACSP Node Geometry
A223352112 Input ACSP Node Geometry from PDES/STEP Exchange File
A223352113 Create ACSP Node Geometry from Existing Geometry
A22335212 Generate and Assign ACSP Element Connectivities
A22335213 Generate and Assign ACSP Element Attributes
A223352131 Generate ACSP Geometric Attributes
A223352132 Generate ACSP Material Angles or Coordinate Systems
A223352133 Generate/Import ACSP Material Properties
A2233521331 Import ACSP Material Properties from PDES/STEP Exchange File
A2233521332 Import ACSP Material Properties from Analysis Materials Database
A2233521333 Generate ACSP Material Properties from Ply Properties, Stacking Sequence and Orientations
A2233521334 Input ACSP Anisotropic Material Property Matrices
A223352134 Assign ACSP Material, Geometric, Material Coordinate System/Angle Attributes to Elements
A22335214 Generate ACSP Graphical Finite Element Models Documentation
A2233522 Generate ACSP Finite Element Analysis Environment and Controls
A22335221 Set/Assign ACSP Boundary Constraints/Releases
A22335222 Generate/Assign ACSP Load Sets and Combinations
A22335223 Assign ACSP Factors of Safety, Durability/Damage Tolerance & Allowables
A22335224 Generate/Assign ACSP Analysis Output Control Requests
A223352241 Request ACSP Deflection Data Output
A223352242 Request ACSP Stress Data Output
A223352243 Request ACSP Strain Data Output
A223352244 Request ACSP Interlaminar Shear Data Output
A223352245 Request ACSP Reaction and Internal Load Data Output
A223352246 Request ACSP Generation/Output of Matrices
A22335225 Generate ACSP Analysis Procedure Controls
A2233523 Perform ACSP Mechanical/Thermo-Mechanical FEA
A22335231 Perform ACSP Linear Analysis
A22335232 Perform ACSP Nonlinear Stability Analysis
A22335233 Perform ACSP Nonlinear Material Analysis
A22335234 Perform ACSP Nonlinear Geometry Analysis
A22335235 Perform ACSP Combined Geometric and Material Nonlinear Analysis
A2233524 Create/Document ACSP Internal Loads/Stress Database

A22335241 Translate ACSP Data from FEA Solver
A22335242 Translate ACSP Data from PDES/STEP Exchange File
A22335243 Generate ACSP Textual Analysis Output Database Documentation
A22335244 Generate ACSP Graphical Analysis Output Database Documentation
A223353 Conduct ACSP Detail Stress Analysis
A2233531 Conduct ACSP Static Strength Analysis
A2233532 Conduct ACSP Fine Grid Finite Element Analysis
A22335321 Generate ACSP Fine Grid Finite Element Model from Coarse Grid Model
A22335322 Apply ACSP Loads/Boundary Conditions from Coarse Grid Model
A22335323 Perform ACSP Finite Element Analysis
A22335324 Calculate ACSP Margins of Safety Based upon Fine Grid Analysis Results
A22335325 Create ACSP Fine Grid Internal Loads/Stress Database Results
A223354 Plan ACSP Tests/Analyze Test Results
A2233541 Produce ACSP Test Part Configuration Documents
A2233542 Produce ACSP Test Plan
A2233543 Perform ACSP Test Surveillance, Validation and Data Review
A2233544 Produce ACSP Test Results Documentation and Feed Back Information to Design
A223355 Analyze ACSP Manufacturing Discrepancies
A223356 Feed Back ACSP Laminate Description, Ply Stacking Sequence and Orientation to Design
A22336 Conduct ACSP Durability and Damage Tolerance Analysis
A223361 Classify ACSP Parts into Safety of Flight/Fracture Critical and Others
A2233611 Apply ACSP Damage Tolerance Critical/Size to Safety of Flight/Fracture Critical ACSP
A22336111 Apply/Size ACSP Based on Scratches
A22336112 Apply/Size ACSP Based on Delaminations
A22336113 Apply/Size ACSP Based on Impacts
A22336114 Apply/Size ACSP Based on 1/4" Holes/Crack criteria
A2233612 Apply Durability and Environmental Threat Criteria to all other ACSPs
A223362 Guide ACSP Material Selection and Setting of Material Criteria
A2233621 ACSP Guide based on Stacking Sequence Optimization
A2233622 ACSP Guide based on Edge Delamination Criteria
A2233623 ACSP Guide based on Sub-Laminate Buckling Criteria
A2233624 ACSP Guide based on Design Details
A2233625 ACSP Guide based on Experimental Results/Validated Analysis Methods
A223363 Set ACSP Non-Destructive Inspection Allowables
A223364 Create ACSP Durability and Damage Tolerance Analysis Decision Record
A2234 Evaluate Detail ACSP Analysis
A22341 Review ACSP Weight, Static, Dynamic, & Thermal Analysis
A22342 Review ACSP Damage Tolerance
A22343 Review ACSP Surface Finish Requirement

A22344 Review ACSP Producibility Analysis
A224 Perform ACSP Production, Design & Analysis Support
A2241 Receive and Review ACSP Class 1 and 2 Changes
A2242 Prepare ACSP Preliminary Modification Package
A22421 Prepare ACSP Preliminary Design Changes
A22422 Conduct ACSP Preliminary Changes Analysis
A22423 Prepare ACSP Producibility Assessment
A22424 Develop ACSP Estimates Cost
A2243 Resolve ACSP Class 2 Changes
A2244 Conduct ACSP Change Board Reviews
A2245 Incorporate ACSP Changes
A22451 Conduct ACSP Detail Design Changes
A22452 Conduct ACSP Detail Analysis Changes
A22453 Resolve ACSP M&P Parameters
A22454 Prepare ACSP AMRs
A22455 Release ACSP Production Drawing Changes
A225 Conduct ACSP Prototype Tests & Evaluation
A226 Manage Configuration of ACSP Data
A23 Build and QA an ACSP
A231 Develop ACSP Plan
A2311 Assume ACSP Structure & Method of Manufacture
A2312 Develop ACSP Production Plan
A2313 Develop ACSP Support Activities Plan
A2314 Develop/Certify ACSP Mfg. Process/Materials
A2315 Determine Detail Method of Manufacture
A23151 Complete Manufacturing Parts List
A23152 Determine Make/Buy Decisions
A23153 Determine Precise Form of Sub-Parts
A232 Develop ACSP Production Plans
A2321 Develop ACSP Process Plans
A23211 Plan Structures Assembly
A23212 Plan Systems Installations
A23213 Develop Sheet Metal Planning
A23214 Develop Machine Parts Planning
A23215 Develop ACSP Bonding/Composite Planning
A232151 Conduct Pre-planning Review
A232152 Identify New Tool Requirements and Generate Tool Orders
A232153 Develop Work Instructions and Build Sequence
A2321531 Identify Standard Operations and Sequence
A2321532 Generate Custom Operations and Sequence
A2321533 Insert Inspections Steps
A2321534 Identify and Resolve Issues
A232154 Review Planning with Affected Organizations
A232155 Audit & Verify Planning

- A232156 Provide Mod Planning
- A23216 Plan for Procured Parts
- A2322 Develop Support Process Plans
- A2323 Control, Validate, & Release Planning
- A233 Provide Tools
  - A2331 Design Tools
    - A23311 Generate Design Criteria
    - A23312 Conduct Conceptual Tool Design
      - A233121 Review Tooling Concept
      - A233122 Define Tool Material
      - A233123 Select Configuration Type
    - A23313 Perform Detail Tool Design
    - A23314 Review and Approve Tool Design
  - A2332 Develop NC Programs/Tapes
    - A23321 Provide Production and Tool NC Programs
      - A233211 Obtain Geometry Data
      - A233212 Define Automated Process Strategy
      - A233213 Define NC Motion Data
      - A233214 Generate Documentation
      - A233215 Post Process NC Program
    - A23322 Control NC Programs
    - A23323 Proof NC Programs
    - A23324 Release NC Programs
  - A2333 Fabricate/Rework Tools
  - A2334 Provide Liaison Support
- A234 Procure ACSP Manufacturing Materials
  - A2341 Control Procurement of ACSP Material
  - A2342 Procure Material
  - A2343 Receive & Inspect Raw Materials
    - A23431 Verify/Record Vendor Documentation
    - A23432 Update & Print Receiving Documentation
    - A23433 Unload Transport
    - A23434 Inspect/Verify Material
    - A23435 Obtain Test Samples
    - A23436 Place Material into Proper Storage Area
  - A2344 Manage and Control Material Inventory
- A235 Produce Product (ACSP)
  - A2351 Perform Production Operations
    - A23511 Obtain Material
      - A235111 Remove Material From Storage/Freezer
      - A235112 Thaw Material
      - A235113 Cut Material To Size & Kit
      - A235114 Transport Material
    - A23512 Obtain & Prepare Tools

        - A235121 Remove Tool From Storage
        - A235122 Clean Tool
        - A235123 Apply Release Agent
        - A235124 Cure Release Agent & Inspect
      - A23513 Layup & Assemble ACSP
      - A23514 Bag & Leak Check ACSP
        - A235141 Obtain Bagging Material & Cut to Fit
        - A235142 Seal Bag
        - A235143 Pull Vacuum & Adjust Bag
        - A235144 Leak Check Bag & Inspect
    - A2352 Cure & Tear Down ACSP
      - A23521 Load Part in Cure Equipment
      - A23522 Connect Vacuum Sensors & Thermocouples
      - A23523 Cure/Debulk/Bond/Dry per Specification
      - A23524 Perform Tear Down Operations
    - A2353 Trim & Drill ACSP
      - A23531 Position Part in Trim/Drill Fixtures
      - A23532 Trim/ Drill Part
        - A235321 Trim Part Periphery
        - A235322 Trim Stiffeners
        - A235323 Drill Holes
        - A235324 Inspect Trim & Drill Operations
      - A23533 Remove Part From Fixture
    - A2354 Assure Product Quality
      - A23541 Perform Non-Destructive Inspections
        - A235411 Seal Part For Ultrasonic Inspection
        - A235412 Perform Ultrasonic Inspection Operation
        - A235413 Perform X-Ray Inspection Operation
        - A235414 Perform Dimension/Visual Inspection
      - A23542 Perform Material Evaluation/Certification
        - A235421 Obtain Material and/or Test Coupons
        - A235422 Verify Chemical/Thermal Properties
        - A235423 Verify Physical Properties
        - A235424 Verify Mechanical properties
      - A23543 Analyze Defects & Disposition Part or Material
    - A2355 Deliver Product
  - A236 Ship Product
    - A2361 Print & Verify Transportation Documents
    - A2362 Protect Part for Shipment
    - A2363 Load Transport
- A24 Support Logistics of an ACSP
  - A241 Perform ACSP Logistics Engineering
  - A242 Support ACSP Reliability/Maintenance Design Studies
  - A243 Write ACSP Technical Manuals and Maintenance Documents

A244 Conduct ACSP Spares
A245 Support ACSP Facilities
A246 Plan and Support ACSP Training System
A3 Use & Maintain an ACSP
A4 Develop & Provide ACSP Materials

2.3.3.2 Part Specific Design Activity List

A231 Create TCA Data
A2311 Prepare TCA Angle Design
A23111 Resolve TCA Angle Mfg. Process
A23112 Resolve TCA Angle Part Periphery
A23113 Resolve TCA Angle Target Layup Orientation
A23114 Resolve TCA Angle Target Thickness
A23115 Determine TCA Angle Ply Counts
A23116 Produce TCA Angle Ply Stack-Up
A231161 Resolve TCA Angle Ply Sequence
A231162 Create TCA Angle Ply Tables
A2311621 Attach TCA Angle Part Numbers
A2311622 Attach TCA Angle Ply Numbers
A2311623 Attach TCA Angle Material Flagnotes
A2311624 Attach TCA Angle Fiber Orientation
A2311625 Attach TCA Angle Splice Flagnote
A2311626 Attach TCA Angle Revision Letter
A231163 Develop TCA Angle Ply Periphery
A231164 Attach TCA Angle Ply Callouts
A2312 Prepare TCA Cap Design
A2313 Prepare TCA Filler Design
A23131 Resolve TCA Filler Geometry Envelope
A23132 Resolve TCA Filler Build/TTU/Quality Issues
A23133 Build TCA Filler Detail Drawing
A232 Create CSL Data
A2321 Resolve CSL Mfg. Process
A2322 Resolve CSL Part Periphery
A2323 Resolve CSL Target Lay-up Orientation
A2324 Resolve CSL Target Thickness area
A2325 Determine CSL Ply Counts
A2326 Produce CSL Ply Stack-Up
A23261 Resolve CSL Ply Sequence
A23262 Create CSL Ply Tables
A232621 Attach CSL Part Numbers
A232622 Attach CSL Ply Numbers
A232623 Attach CSL Material Flagnotes
A232624 Attach CSL Fiber Orientation

A232625 Attach CSL Splice Flagnote
A232626 Attach CSL Revision Letter
A23263 Develop CSL Ply Periphery
A23264 Attach CSL Ply Callouts
A233 Create CSP Data
A2331 Prepare CSP Skin Details
A23311 Resolve CSP Skin Mfg. Process
A23312 Resolve CSP Skin Part Periphery
A23313 Resolve CSP Skin Target Layup Orientation
A23314 Resolve CSP Skin Target Thickness
A23315 Determine CSP Skin Ply Counts
A23316 Produce CSP Skin Ply Stack-Up
A233161 Resolve CSP Skin Ply Sequence
A233162 Create CSP Skin Ply Tables
A2331621 Attach CSP Skin Part Numbers
A2331622 Attach CSP Skin Ply Numbers
A2331623 Attach CSP Skin Material Flagnotes
A2331624 Attach CSP Skin Fiber Orientation
A2331625 Attach CSP Skin Splice Flagnote
A2331626 Attach CSP Skin Revision Letter
A233163 Develop CSP Skin Ply Periphery
A233164 Attach CSP Skin Ply Callouts
A2332 Prepare CSP Core Details
A23321 Collect & Layout CSP Core Geometry
A23322 Develop CSP Core Periphery
A233221 Resolve CSP Core Edge Band Issues
A233222 Resolve CSP Core Internal Fittings
A233223 Resolve CSP Core Fillers
A23323 Design CSP Core Thickness, Density & Matl.
A233231 Resolve CSP Core Thickness
A233232 Resolve CSP Core Density
A233233 Resolve CSP Core Material Features
A23324 Design CSP Core Transition Area
A23325 Design CSP Core Ribbon Direction
A2333 Resolve CSP Interfaces
A33 Integrate & Prepare ACSP Assy. Dwg.
A331 Integrate & Prepare TCA Assy. Drawings
A3311 Collect TCA Angle Data
A3312 Collect TCA CAP Data
A3313 Collect TCA Filler Data
A3314 Prepare TCA Assy. Drawing
A332 Integrate & Prepare CSL Assy. Drawings
A333 Integrate & Prepare CSP Assy. Drawings
A3331 Collect CSP Core & Skin Data

A3332 Resolve CSP Core Adhesive Design
A3333 Resolve CSP Vapor Barrier Design
A3334 Design CSP Item Location for Core, Skins, Padups, Recesses & Holes
A3335 Attach Filler Plies in Transition Areas
A41 Review ACSP Weight, Static, Dynamic & Thermal Analysis
A411 Review TCA Weight, Static, Dynamic & Thermal Analysis
A4111 Review TCA Cap Analysis
A4112 Review TCA Angle Analysis
A4113 Review TCA Filler Analysis
A412 Review CSL Weight, Static, Dynamic & Thermal Analysis
A4121 Review CSL Skin Analysis
A4122 Review CSL Edge & Fastener Analysis
A413 Review CSP Weight, Static, Dynamic & Thermal Analysis
A4131 Review CSP Skin Analysis
A4132 Review CSP Core Analysis
A4133 Review CSP Edge & Fastener Analysis

2.3.3.3 Part Specific Analysis Activity List

A31 Generate ACSP Geometric Attributes
A311 Generate TCA Geometric Attributes
A3111 Generate TCA Equivalent Cross Sectional Area
A3112 Generate TCA Equivalent Cross Sectional Properties
A3113 Generate TCA Equivalent Thicknesses
A312 Generate CSL Geometric Attributes
A3121 Generate CSL Shell Offsets
A3122 Generate CSL Shear Panel Core Area Equivalents
A3123 Generate CSL Equivalent Thicknesses
A313 Generate CSP Geometric Attributes
A3131 Generate CSP Shell Offsets
A3132 Generate CSP Shear Panel Core Area Equivalents
A3133 Generate CSP Solid Element Core Equivalent Properties
A3134 Generate CSP Equivalent Thicknesses
A34 Input ACSP Anisotropic Material Property Matrices
A341 Input TCA Anisotropic Material Property Matrices
A3411 Input TCA Equivalent Cross Sectional Area Modulus of Elasticity
A3412 Input TCA Cross Sectional Anisotropic Material Property Matrices
A3413 Input TCA Shell Element Anisotropic Material Property Matrices
A342 Input CSL Anisotropic Material Property Matrices
A3421 Input CSL Shell Element Anisotropic Material Property Matrices
A3422 Input CSL Solid Element Anisotropic Material Property Matrices
A343 Input CSP Anisotropic Material Property Matrices
A3431 Input CSP Face Sheet Anisotropic Material Property Matrices
A3432 Input CSP Core Anisotropic Material Property Matrices

- A3433 Input CSP Face Sheet and Core Anisotropic Material Property Matrices

- A31 Conduct ACSP Static Strength Analysis
  - A311 Conduct TCA Static Strength Analysis
    - A3111 Conduct TCA Composite Joint Analysis
    - A3112 Conduct TCA Composite Fastener Pull-Through Analysis
    - A3113 Conduct TCA Composite Cutout Analyses
    - A3114 Conduct TCA Composite Point Stress Analysis
    - A3115 Conduct TCA Beam Buckling and Crippling Analyses
    - A3116 Conduct TCA Beam Stiffener Pull-off Analyses
  - A312 Conduct CSL Static Strength Analyses
    - A3121 Conduct CSL Composite Joint Analyses
    - A3122 Conduct CSL Composite Fastener Pull-Through Analyses
    - A3123 Conduct CSL Composite Cutout Analyses
    - A3124 Conduct CSL Composite Point Stress Analysis
    - A3125 Conduct CSL Panel Analyses
  - A313 Conduct CSP Static Strength Analyses
    - A3131 Conduct CSP Composite Joint Analyses
    - A3132 Conduct CSP Composite Fastener Pull-Through Analyses
    - A3133 Conduct CSP Composite Cutout Analyses
    - A3134 Conduct CSP Composite Point Stress Analysis
    - A3135 Conduct CSP Panel Analyses
- A32 Define ACSP Structural Configuration
  - A321 Define TCA Structural Configuration
    - A3211 Define TCA Initial Ply Orientations
    - A3212 Define TCA Initial Ply Distributions
    - A3213 Define TCA Initial Stiffener Geometry
  - A322 Define CSL Structural Configuration
    - A3221 Define CSL Initial Ply Orientation
    - A3222 Define CSL Initial Ply Distribution
  - A323 Define CSP Structural Configuration
    - A3231 Define CSP Initial Ply Orientations
    - A3232 Define CSP Initial Ply Distribution
    - A3233 Define CSP Initial Core Geometry
    - A3234 Define CSP Initial Core Orientation
    - A3235 Define CSP Initial Core Distribution
- A42 Optimize ACSP Structural Configuration
  - A421 Optimize TCA Structural Configuration
    - A4211 Optimize TCA Initial Ply Orientations
    - A4212 Optimize TCA Initial Ply Distributions
    - A4213 Optimize TCA Initial Stiffener Geometry
  - A422 Optimize CSL Structural Configuration
    - A4221 Optimize CSL Initial Ply Orientation
    - A4222 Optimize CSL Initial Ply Distribution
  - A423 Optimize CSP Structural Configuration

A4231 Optimize CSP Initial Ply Orientations
A4232 Optimize CSP Initial Ply Distribution
A4233 Optimize CSP Initial Core Geometry
A4234 Optimize CSP Initial Core Orientation
A4235 Optimize CSP Initial Core Distribution

2.3.3.4 Part Specific Build Activity List

A13 Layup and Assemble ACSP
A131 Layup and Assemble "T" Composite Assembly (TCA)
A1311 Layup TCA "L" Channels
A13111 Clean TCA Tool
A13112 Position TCA Ply
A13113 Compact TCA Ply and Inspect
A13114 Inspect TCA Layup
A1312 Layup TCA Radius Filler
A13121 Wind TCA Roving and Cut to Length
A13122 Place TCA Roving in Tool
A13123 Compact TCA Roving
A13124 Inspect TCA Filler
A1313 Assemble TCA "L" Channels and Filler
A13131 Position TCA "L" Channels
A13132 Position TCA Filler
A13133 Install TCA Assembly Tools and Inspect
A1314 Layup TCA Cap and Inspect Assembly
A13141 Position TCA Cap Ply Detail
A13142 Compact TCA Ply and Inspect
A13143 Position TCA Caul Plate
A13144 Inspect TCA Assembly
A132 Layup and Assemble Contoured Skin Laminate (CSL)
A1321 Clean CSL Tool
A1322 Position CSL Ply Detail
A1323 Compact CSL Ply Detail and Inspect
A1324 Inspect CSL Layup
A133 Layup and Assemble Core Stiffened Panel (CSP)
A1331 Build CSP Core Assembly
A13311 Cut CSP Core to Size
A13312 Perform CSP Machining Operations
A13313 Perform CSP Forming Operations
A13314 Apply/Cure CSP Stabilizers and Potting Compound
A13315 Apply CSP Adhesive/Assemble Core
A13316 Inspect CSP Core Assemblies
A1332 Layup CSP IML Skin
A13321 Clean CSP Tool

A13322 Position CSP IML Ply
A13323 Compact CSP IML Ply and Inspect
A13324 Inspect CSP Layup
A1333 Assemble CSP Core and Skin
A13331 Position CSP Core Locating Template
A13332 Apply CSP Film Adhesive
A13333 Verify CSP Core Fit
A13334 Position CSP Core and Inspect
A1334 Layup CSP OML Skin
A13341 Position CSP OML Ply
A13342 Compact CSP OML Ply and Inspect
A13344 Inspect CSP OML Layup

2.3.4 General IDEF0 Diagrams and Glossaries

The IDEF0 diagrams and their associated glossaries have been developed based on the hierarchy activity structure shown in the node trees and the indentured lists. Within this section the general structure of the format is to start each sub-section with an indentured list. The activities for which IDEF0 diagrams have been developed are **bold faced**. The indentured list is followed by the top IDEF0 diagram and its associated intentionally blank page where the diagram acts as a sub-section break. The only exception to this style is the top A-0 Procure, Build & Use an ACSP which has an accompanying glossary page. All of the IDEF0 diagrams in each sub-section have an accompanying glossary page. The general sequence of pages in each of the sub-sections is:

- Indentured List
- Top Section IDEF0 Diagram
- Blank page except for the A-0 node
- Next IDEF0 Diagram
- Associated Glossary Page
- Repeat IDEF0 Diagram/Glossary as necessary

To facilitate the cross-functional and functional views of the life cycle of the General ACSP, the model has been divided into the following node sections:

- A-0 Procure, Build & Use an ACSP
- A2232 Create Detail ACSP Design
- A2233 Conduct Detail ACSP Analysis
- A23 Build and QA an ACSP

The A-0 section represents the general multi-functional ACSP viewing the life cycle, with particular emphasis on aerospace Design/Analyze/Build preliminary and interface activities. The remaining areas of this section show, the functional views of Detail Design, Detail Analysis and Build/QA of an ACSP.

PROCURE, BUILD & USE AN ACSP

General Design/Analysis/Build Indentured List

A0 Procure, Build, & Use an Aircraft Composite Structural Part
A1 Develop ACSP Needs & Procurement
A2 Manage, Design, Build, & Support an ACSP
  A21 Manage ACSP Integrated Product Development (IPD)
    A211 Manage ACSP Design Process
    A212 Manage ACSP Build Process
    A213 Manage ACSP Support Process
    A214 Manage ACSP Resources
      A2141 Manage ACSP People Resources
      A2142 Manage ACSP Tool Resources
      A2143 Manage ACSP Facility Resources
      A2144 Manage ACSP Time and Cost Budgets
    A215 Manage ACSP Integration
  A22 Design & Analyze an ACSP
    A221 Collect, Review, Define & Distribute ACSP Requirements
      A2211 Collect and Review other Engineering ACSP Requirements
      A2212 Collect and Review Build and QA ACSP Requirements
      A2213 Collect and Review Support Logistics ACSP Requirements
    A222 Perform ACSP Preliminary Design and Analysis
      A2221 Prepare Preliminary ACSP Design
        A22211 Evaluate ACSP Preliminary Loads
        A22212 Obtain ACSP M&P Support
        A22213 Prepare ACSP Design Concepts
          A222131 Select ACSP Geometry System
          A222132 Build ACSP Concept Geometry
            A2221321 Develop ACSP Structural Concepts
            A2221322 Prepare ACSP Candidate Drawings
            A2221323 Evaluate ACSP Analysis Results
            A2221324 Develop ACSP Trade Study Concepts
            A2221325 Select/Detail ACSP Preliminary
          A222133 Prepare ACSP Functional Interface Concept Drawings
          A222134 Perform ACSP In House PDRS
      A2222 Conduct Preliminary ACSP Analysis
        A22221 Review ACSP Design Data
          A222211 Review ACSP Layouts
            A2222111 Review ACSP Geometry
            A2222112 Review ACSP Sizes
            A2222113 Obtain ACSP Initial Weights and Balances
          A222212 Review ACSP Material Selections
            A2222121 Select ACSP Composite or Homogeneous Material
            A2222122 Screen ACSP Available Materials
            A2222123 Collect ACSP Existing Material Data

A2222124 Define ACSP Material Development Program
A2222125 Generate, & Collect/Reduce ACSP Material Test Data
A2222126 Create ACSP Analysis Materials Database
A222213 Conduct ACSP Baseline Analysis
A2222131 Define ACSP Critical Dimensions
A2222132 Define ACSP Structural Configuration
A222214 Conduct ACSP Trade Study Analysis
A2222141 Optimize ACSP Critical Dimensions
A2222142 Optimize ACSP Structural Configuration
A2222143 Support ACSP Design Trades
A22222 Define ACSP Design Criteria
A222221 Review ACSP SOW Specifications
A222222 Select ACSP Environments
A222223 Select ACSP Limits
A22223 Create ACSP Preliminary Analysis Decision Record
A2223 Select Optimum ACSP Design
A2224 Develop ACSP Prototype
A223 Perform ACSP Detail Design & Analysis
A2234 Evaluate Detail ACSP Analysis
A22341 Review ACSP Weight, Static, Dynamic, & Thermal Analysis
A22342 Review ACSP Damage Tolerance
A22343 Review ACSP Surface Finish Requirement
A22344 Review ACSP Producibility Analysis
A3 Use & Maintain an ACSP
A4 Develop & Prepare ACSP Materials

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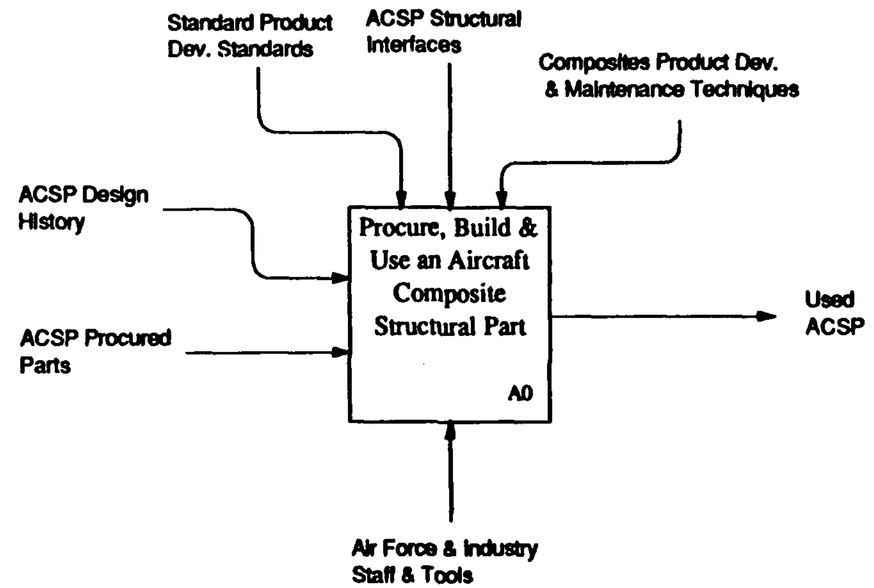


Purpose : Build a process model that describes the relationships between activities in the design, analysis & build of an Aircraft Composite Structural Part (ACSP) that falls in the "AS WAS" and "AS IS" environment.
This is to support the development of a PDES data structure that is specific to composite structures in a typical aircraft.

Context : This model will show a level of detail in the aforementioned functions that shows the composite items that make up a Composite Structural Part as displayed on a releasable dataset to Build and QA functions.

Viewpoint : Structural Aircraft Composites Integrated Product Development Team

A-0: Procure, Build, and Use an Aircraft Composite Structural Part (ACSP)

Activities:

A0 Procure, Build & Use an Aircraft Composite Structural Part
This activity covers the entire life cycle of an ACSP as viewed from the combined activity groupings of the DoD needs analysis and procurement, aerospace contractors, DoD's use and maintenance, and the raw material suppliers.

Inputs:

I1 ACSP Design History
The ACSP design history consists of all the similar design activities that have created data that is similar to the ACSP.

I2 ACSP Procured Parts
These are the as-built ACSP parts as purchased from the outside associate or subcontractors.

Controls:

C1 Standard Product Dev. Standards
These are the standard aerospace product development standards that apply to ACSP.

C2 ACSP Structural Interfaces
These are all the structural interfaces that mate with the ACSP.

C3 Composites Product Dev. & Maintenance Techniques
These techniques consist of Composites Product Development, Maintenance and Material Development Techniques.

- Composites Product Development Techniques
  The standard product development techniques for composites involve the standard design, analysis, and build procedures and specifications.

- Composites Maintenance Techniques
  The are the Composites Maintenance Techniques as practiced in the field

- Composites Material Development Techniques
  These are the Material Development Techniques as practiced by the material suppliers.

Outputs:

Used ACSP - *This is the ACSP as a result of use in the field.*

Mechanisms:

M1 Air Force & Industry Staff & Tools
This consists of staff & tools from the contractor, Air Force and materials supplier.

- ACSP M/D/B/S Staff
  These are the specific people and tools necessary to perform the manage, design, build and support functions.

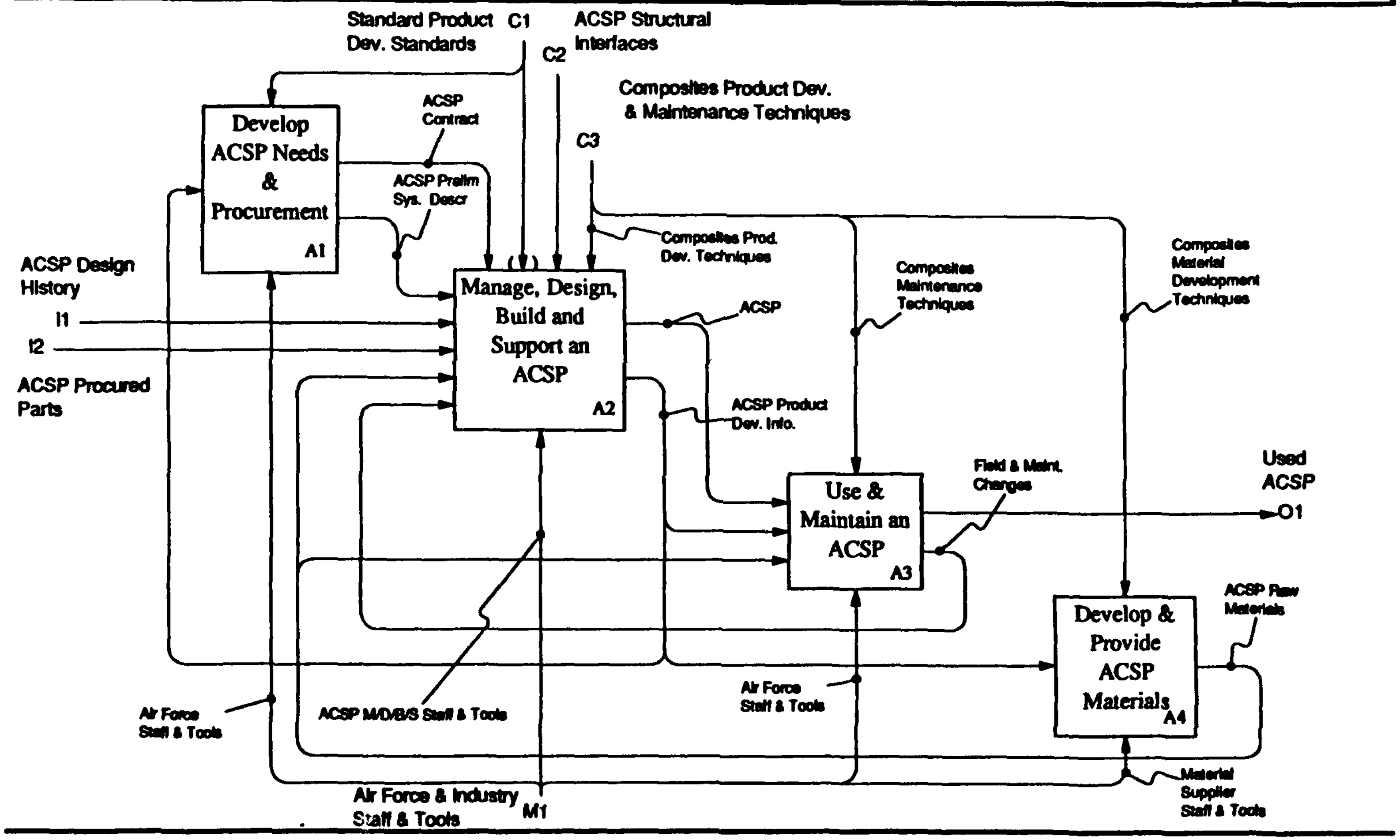
- Air Force Staff & Tools
  These are the specific people and tools necessary to perform the Air Force tasks.

- Material Supplier Staff & Tools
  These are the specific people and tools necessary to perform the material development tasks.

Process Interactions:

(None)

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A0	TITLE: Procure, Build & Use an Aircraft Composite Struc			



A0: Procure, Build & Use an Aircraft Composite Structure

Activities:

A2 Manage, Design, Build and Support an ACSP
This activity consists of all the contracted management of resources, design, build, and support of a typical ACSP, as done at the prime contracting aerospace company.

A1 Develop ACSP Needs & Procurement
This activity is the DoD analysis of the ACSP needs based on the department force structure needs and the state of ACSP technologies, along with the procurement process throughout the life cycle as managed at DoD level.

A3 Use & Maintain an ACSP
This activity is the DoD's use and maintenance of an ACSP. It also includes repair, redesign, and modification activities of an ACSP at an ALC.

A4 Develop & Provide ACSP Materials
This activity is the material suppliers process of creating stock material for composite manufacturers. Basic material properties and allowables are addressed here.

Inputs:

I1 ACSP Design History
The ACSP design history consists of all the similar design activities that have created data that is similar to the ACSP.

I2 ACSP Procured Parts
The ACSP design history consists of all the similar design activities that have created data that is similar to the ACSP.

Controls:

C1 Standard Product Dev. Standards
These are the standard aerospace product development standards that apply to ACSP.

C2 ACSP Structural Interfaces
These are all the structural interfaces that mate with the ACSP.

C3 Composites Prod. Dev. & Maintenance Techniques
These techniques consist of Composites Product Development, Maintenance and Material Development Techniques.

- Composites Product Development Techniques
  The standard product development techniques for composites involve the standard design, analysis, and build procedures and specifications.

- Composites Maintenance Techniques
  These are the Composites Maintenance Techniques as practiced in the field.

- Composites Material Development Techniques
  These are the Material Development Techniques as practiced by the material suppliers.

Outputs:

Used ACSP - This is the ACSP as a result of use in the field.

Mechanisms:

M1 Air Force & Industry Staff & Tools
This consists of staff & tools from the contractor, Air Force and materials supplier.

- ACSP M/D/B/S Staff & Tools
  These are the specific people and tools necessary to perform the manage, design, build and support functions.

- Air Force Staff .. Tools
  These are the specific people and tools necessary to perform the Air Force tasks.

- Material Supplier Staff & Tools
  These are the specific people and tools necessary to perform the material development tasks.

Process Interactions:

- ACSP
  This is the as-built ACSP development.

- ACSP Prelim. Sys. Descr.
  The preliminary ACSP system description consists of the business, design, build and logistics system description.

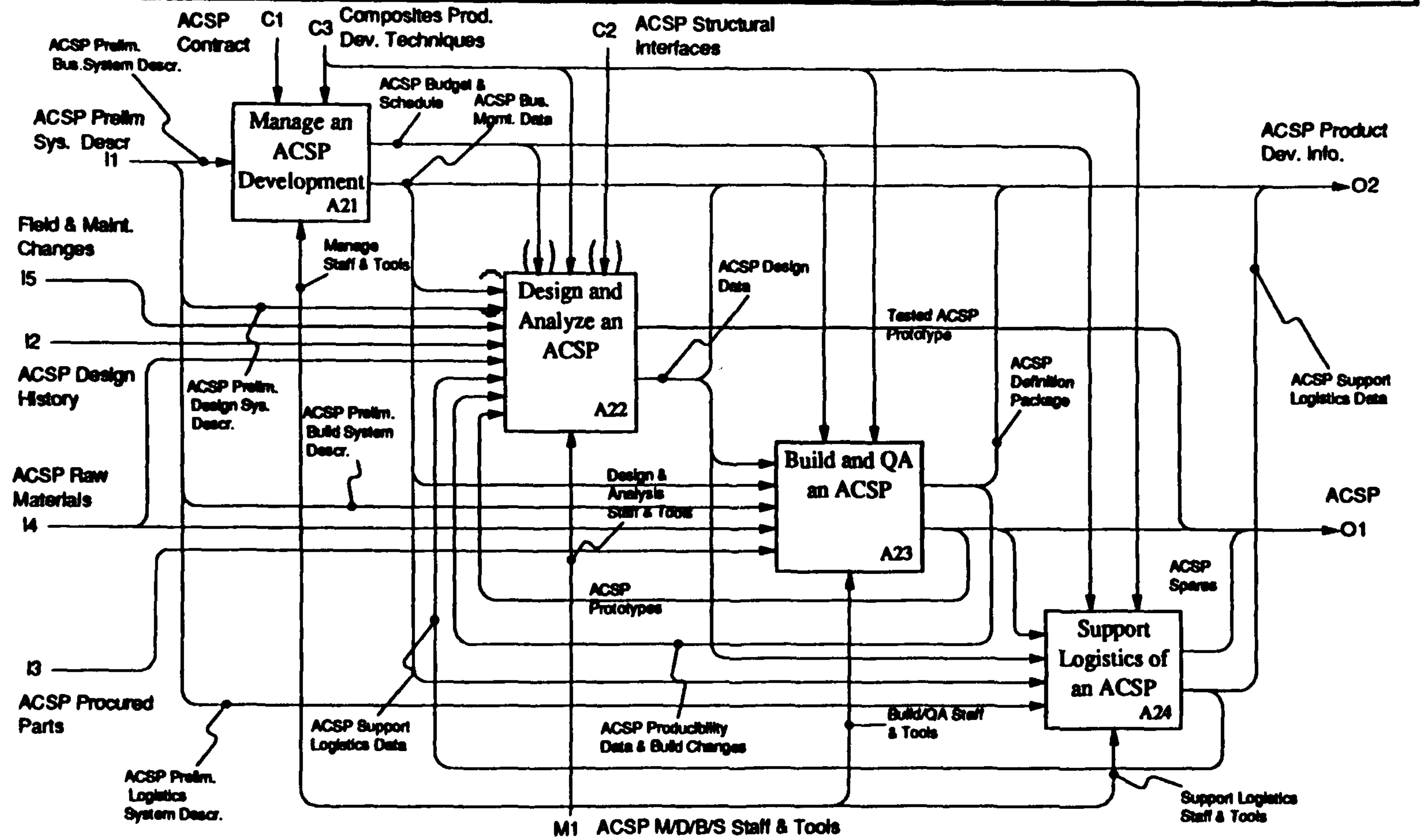
- ACSP Raw Materials
  All of the raw materials as received from the material supplier. These are for the composite items of the ACSP.

- ACSP Product Dev. Info.
  The ACSP product development information consists of the business management, design, definition package and of logistics support parts for the ACSP.

- Field and Maintenance Changes
  These are the reviewed field/maintenance changes that result from in field use of the ACSP.

- ACSP Contract
  This is the contract for the ACSP development as received from the customer.

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A2	TITLE: Manage, Design, Build and Support an ACSP			



A2: Manage, Design, Build and Support an ACSP

Activities:

A21 **Manage an ACSP Development**
These activities involve managing all the resources specific to the ACSP through the design, build and support functions. This includes people, budgets, tools, materials, etc.

A22 **Design and Analyze an ACSP**
This activity involves the complete design and analysis life cycle from the pre-proposal phase to product support in the field.

A23 **Build and QA an ACSP**
The conversion of a design into a finished product and quality assurance functions that assure that the product meets requirements. This is usually a repetitive function, continuing substantially throughout the product's life cycle. It receives the design from design functions and outputs the products, spare and repair parts, and technical data on each instance of the product.

A24 **Support Logistics of an ACSP**
This activity involves the logistics engineering, reliability and maintainability design studies, technical and maintenance documents, spares and training systems that the ACSP repairs.

Inputs:

I1 **ACSP Prelim. System Descr.**
The preliminary ACSP system description consists of the business, design, build and logistics system description.

- ACSP Prelim. Bus. System Descr.
  The ACSP preliminary business system description contains the system relationships of the budget, schedule and costs of a preliminary ACSP.

- ACSP Prelim. Design Sys. Descr.
  The ACSP preliminary design system description shows the functional, geometrical and fit-up of a preliminary ACSP using a graphical/textual system engineering language.

- ACSP Prelim. Build System Descr.
  The ACSP preliminary build system description shows the system view of the manufacturing activities and resources needed to support the ACSP. production.

- ACSP Preliminary Logistics System Description
  The ACSP preliminary logistics system description shows the system view of the relationship between the logistics engineering, reliability and maintainability, spares and training systems of a preliminary ACSP.

I2 **ACSP Design History**
These are the as-built ACSP parts as purchased from the outside associate or subcontractors.

I3 **ACSP Procured Parts**
These are the as-built ACSP parts as purchased from the outside associate or subcontractors.

I4 **ACSP Raw Materials**
All of the raw materials as received from the material supplier. These are for the composite items of the ACSP.

I5 **Field & Maintenance Changes**
These are the reviewed field/maintenance changes that result from in field use of the ACSP.

Controls:

C1 **ACSP Contract**
This is the contract for the ACSP development as received from the customer.

C2 **ACSP Structural Interfaces**
These are all the structural interfaces that mate with the ACSP.

C3 **Composites Product Development Techniques**
The standard product development techniques for composites involve the standard design, analysis, and build procedures and specifications.

Outputs:

O1 **ACSP**
This is the as-built ACSP

O2 **ACSP Product Dev. Info**
The ACSP product development information consists of the business management, design, definition package and logistics support parts for the ACSP.

- ACSP Bus. Mgmt. Data
  This consists of all the budget, cost, schedule and people use data for the ACSP development.

- ACSP Design Data
  ACSP design data consists of all the configuration managed design and analysis information that occurs for preliminary, detail and production support phases of the ACSP.

- ACSP Support Logistics Data
  This ACSP support logistics data consists of all the logistics engineering, reliability and maintainability, technical and maintenance, documents and spares data needed to support the ACSP.

- ACSP Definition Package
  This consists of the as-built configuration management data of the ACSP.

Mechanisms:

M1 ACSP M/D/B/S Staff & Tools
These are the specific people and tools necessary to perform the manage, design, build and support functions.

- Design & Analysis Staff & Tools
  These are the specific people and tools necessary to perform the design and analysis tasks.

- Manage Staff & Tools
  These are the specific people and tools necessary to perform the management of resources tasks.

- Build/QA Staff & Tools
  These are the specific people and tools necessary to perform the build and QA tasks.

- Support Logistics Staff & Tools
  These are specific people and tools necessary to perform the support logistics tasks.

Process Interactions:

- ACSP Bus. Mgmt. Data
  This consists of all the budget, cost, schedule and people use data for the ACSP development.

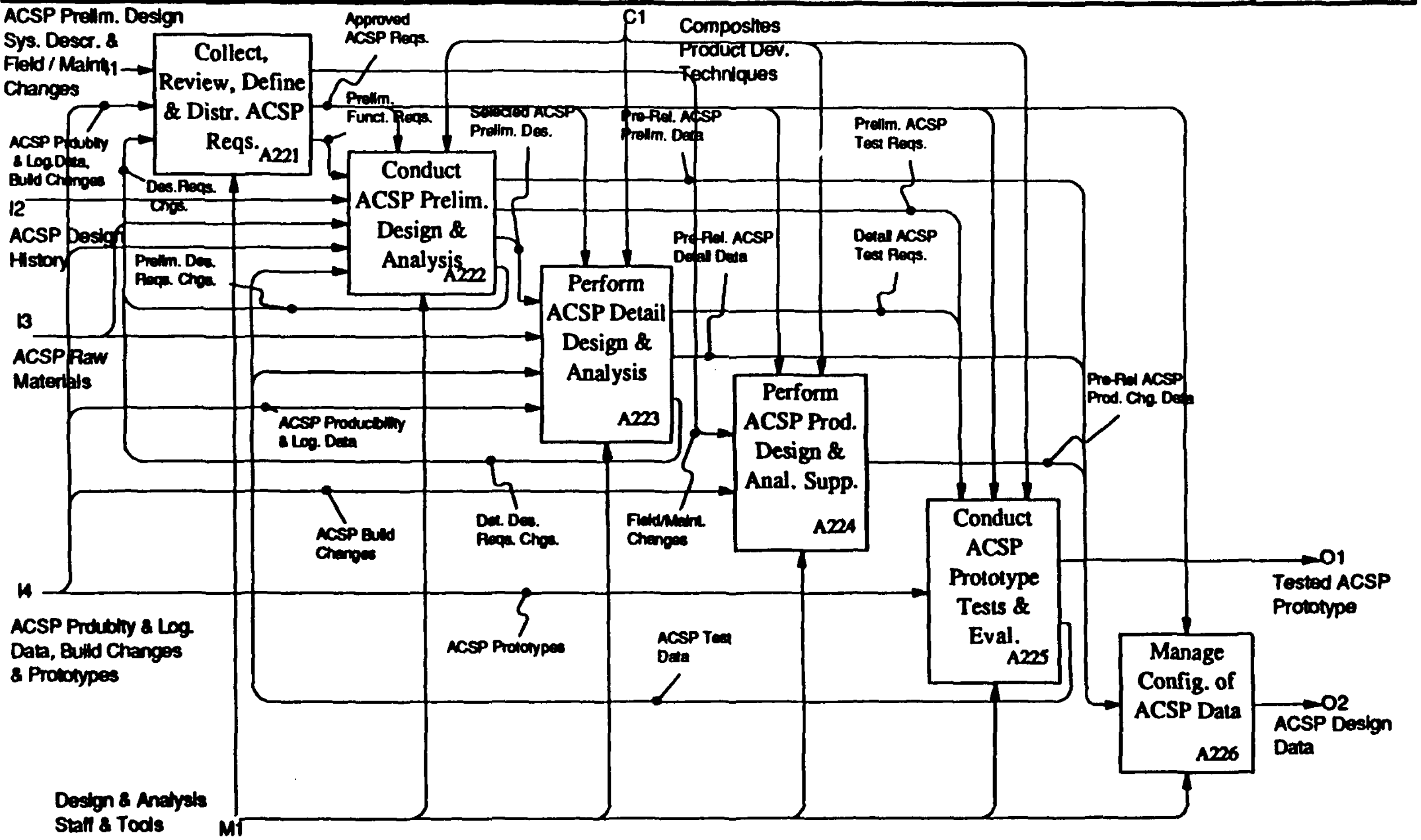
- ACSP Budget & Schedule
  This the ACSP budget and schedule

- ACSP Design Data
  ACSP design data consists of all the configuration managed design and analysis information that occurs for preliminary, detail and production support phases of the ACSP.

- ACSP Support Logistics Data
  This ACSP support logistics data consists of all the logistics engineering, reliability and maintainability, technical and maintenance, documents and spares data needed to support the ACSP.

- ACSP Definition Package
  This consists of the as-built configuration management data of the ACSP.

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A22	TITLE: Design and Analyze an ACSP			



A22:Design and Analyze an ACSP

Activities:

A221 Collect, Review, Define & Distribute ACSP Reqs.
This activity involves collecting, reviewing, defining and distributing structural, cross-functional engineering, build, QA and logistic support requirements of the ACSP.

A222 Conduct ACSP Prelim. Design & Analysis
This activity consists of the preliminary design and analysis of various ACSP concepts in order to trade performance, cost and producibility parameters for selecting an optimum ACSP concept.

A223 Perform ACSP Detail Design & Analysis
This activity involves testing the selected preliminary ACSP design concept and developing it in sufficient detail to meet the desired performance, cost and production goods.

A224 Perform ACSP Prod. Design & Analysis Support
This activity involves supporting all the design and analysis needed to resolve the changes encountered in manufacturing and/or those from in field use of the ACSP.

A225 Conduct ACSP Prototype Tests & Eval.
This activity involves all the physical and electronically simulated tests and evaluation of ACSP prototypes.

A226 Manage Config. of ACSP Data
This activity involves the configuration management of all the data produced in the design development of the ACSP.

Inputs:

I1 ACSP Preliminary Design Sys. Descr. & Field/Main. Changes
The ACSP preliminary design system description shows the functional, geometrical and fit-up of a preliminary ACSP using a graphical/textual system engineering language. Field/maintenance changes are a result of field use activities on ACSP.

I2 ACSP Design History
The ACSP design history consists of all the similar design activities that have created data that is similar to the ACSP.

I3 ACSP Raw Materials
All of the raw materials as received from the material supplier. These are for the composite items of the ACSP.

I4 ACSP Produce & Log. Data, Build Changes & Prototypes
The ACSP produce and logistics data is derived from the various manufacturing maintainability and in-field product support studies of the ACSP. Build changes are these manufacturing changes that occur while producing the ACSP.

- ACSP Prototypes
  The ACSP prototypes consist of all the pre-production physical or electronic models of the ACSP.

- ACSP Producibility & Logistics Data
  The ACSP producibility and logistics data is derived from the various manufacturing, maintainability and in-field product support studies done for the ACSP.

- ACSP Build Changes
  ACSP build changes are those that are occurring during the production process of the ACSP.

Controls:

C1 Composites Product Development Techniques
The standard product development techniques for composites involve the standard design, analysis, and build procedures and specifications.

- Composites Design Techniques
  The standard composites design techniques involve the modeling, drawing, tolerancing and note attachment techniques that facilitate design development.

- Composites Analysis Techniques
  The standard composites analysis techniques involve the unique composite analysis algorithms for dealing with shapes and composite materials of the ACSP

Outputs:

O1 Tested ACSP Prototype
The tested ACSP prototype consists of the performance loaded physical or simulated ACSP.

O2 ACSP Design Data
ACSP design data consists of all the configuration managed design and analysis information that occurs for preliminary, detail and production support phases of the ACSP.

Mechanisms:

M1 Design & Analysis Staff & Tools
These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

- Prelim. Funct. Reqs.
  These are the preliminary functional structural ACSP requirements.

- Selected ACSP Prelim. Des.
  The ACSP preliminary design selected from the various concepts that were traded, is now ready for the detail design phase.

- ACSP Test Data
  All of the ACSP test data from the structural verification test of the ACSP and its subcomponents.

- Prelim. Des. Reqs. Chgs.
  The preliminary design requirements changes based on the analysis, producibility and maintainability results.

- Detail Des. Reqs. Chgs.
  The detail design requirements changes based on the analysis, producibility and maintainability results.

- Pre-Rel. ACSP Prelim. Data
  This is the pre-released ACSP preliminary design and analysis data.

- Pre-Rel. ACSP Detail Data
  This is the pre-released ACSP detail design and analysis data.

- Prelim. ACSP Test Reqs.
  These are the preliminary ACSP test requirements based on the preliminary design and analysis of the ACSP.

- Detail ACSP Test Reqs.
  These are the detail ACSP test requirements based on the preliminary detail and analysis of the ACSP.

- Pre-Rel. ACSP Prod. Chg. Data
  This is the pre-released production support design and analysis data of the ACSP.

- Approved ACSP Reqs.
  These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. They include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

- Field/Maint. Changes
  These are the reviewed field/maintenance changes that result from in-field use of the ACSP.

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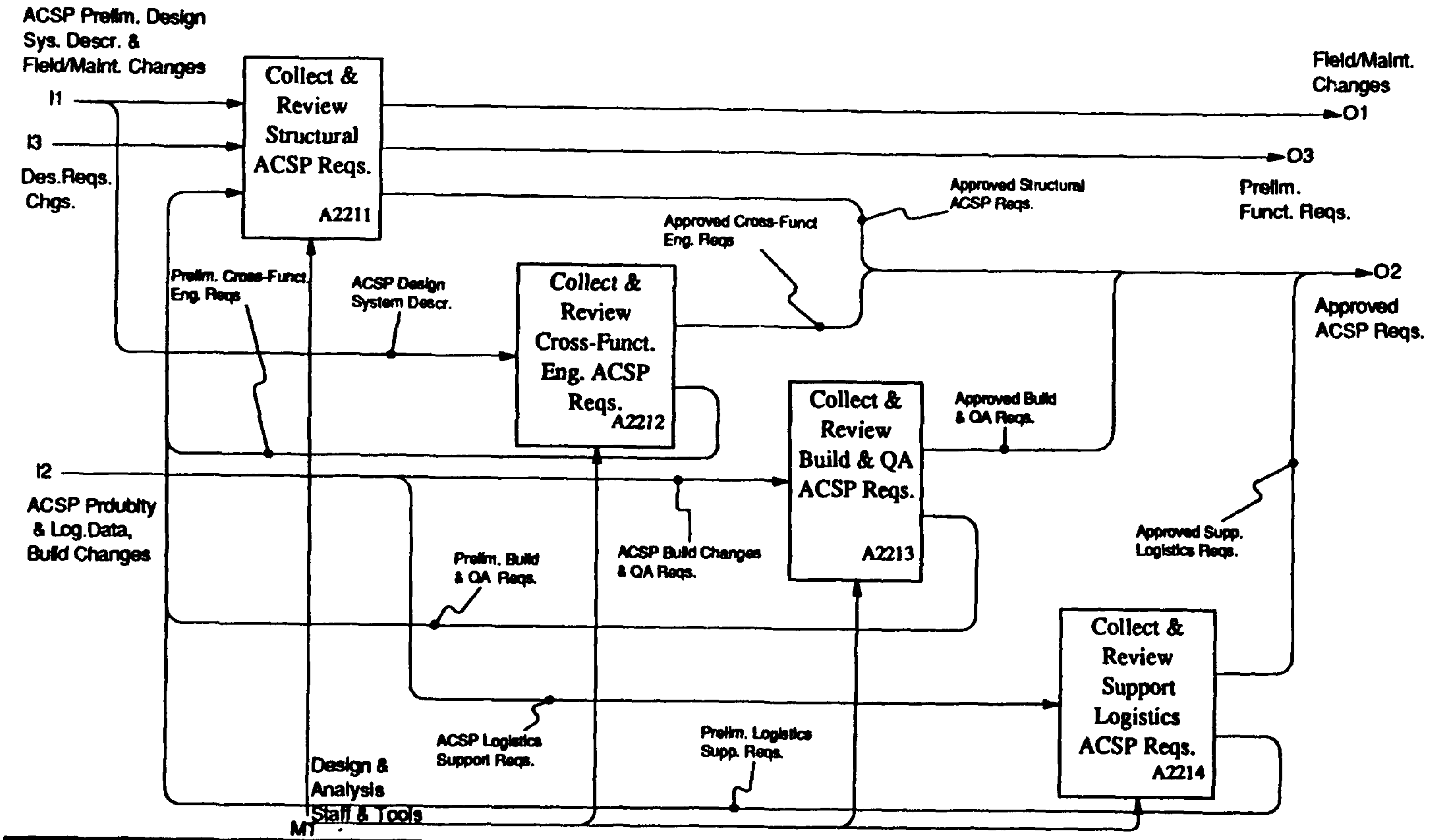
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A221	TITLE: Collect, Review, Define & Distr. ACSP Reqs.					



A221:Collect, Review, Define & Distribute ACSP Requirements

Activities:

A2211 Collect, Review, Structural ACSP Reqs.
Collect and review all the necessary ACSP structural requirements as created internal and external to the structures' function.

A2212 Collect & Review Cross-Function Eng. ACSP Reqs.
Collect and review all the cross-functional engineering ACSP requirements that affect the ACSP structure.

A2213 Collect & Review Build & QA ACSP Reqs.
Collect and review all the build and QA ACSP requirements that are identified to apply to the manufacturability and inspectability of an ACSP.

A2214 Collect & Review Support Logistics ACSP Reqs.
Collect and review all the reliability and maintainability requirements of the ACSP.

Inputs:

I1 ACSP Preliminary Design Sys. Descr. & Field/Main. Changes
The ACSP preliminary design system description shows the functional, geometrical and fit-up of a preliminary ACSP using a graphical/textual system engineering language. Field/maintenance changes are a result of field use activities on ACSP.

- ACSP Design System Description
  (See above)

I2 ACSP Producibility & Log. Data, Build Changes
The ACSP producibility and logistics data is derived from the various manufacturing, maintainability and in-field product support studies of the ACSP. Build changes are those manufacturing changes that occur while producing the ACSP.

I3 Design Requirement Changes
Design requirements changes consist of those incurred while in the preliminary and detail design phase of the ACSP.

- *ACSP Logistics Support Requirements*
  ACSP logistics support requirements and primarily the reliability and maintainability requirements of the ACSP.

Controls:

(None)

Outputs:

O1 Field/Maint. Changes
These are the reviewed field/maintenance changes that result from in-field use of the ACSP.

O2 Approved ACSP Reqs.
The approved ACSP requirement consist of the structural, cross-functional engineering, build, QA and logistics support requirements.

- Approved Structural ACSP Reqs.
  These are the reviewed then approved structural design requirements that were generated internal or external to the structures function for the ACSP.
- Approved Cross-Function Engineering Reqs.
  These are the reviewed then approved ACSP cross-functional engineering requirements that affect the structure.
- Approved Build & QA Reqs.
  These are reviewed and approved build and QA requirements that apply to the manufacturability and inspectability of the ACSP.
- Approved Supp. Logistics Reqs.
  These are the reviewed and approved reliability and maintainability requirements of the ACSP.

Mechanisms:

M1 Design & Analysis Staff & Tools
These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.
- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

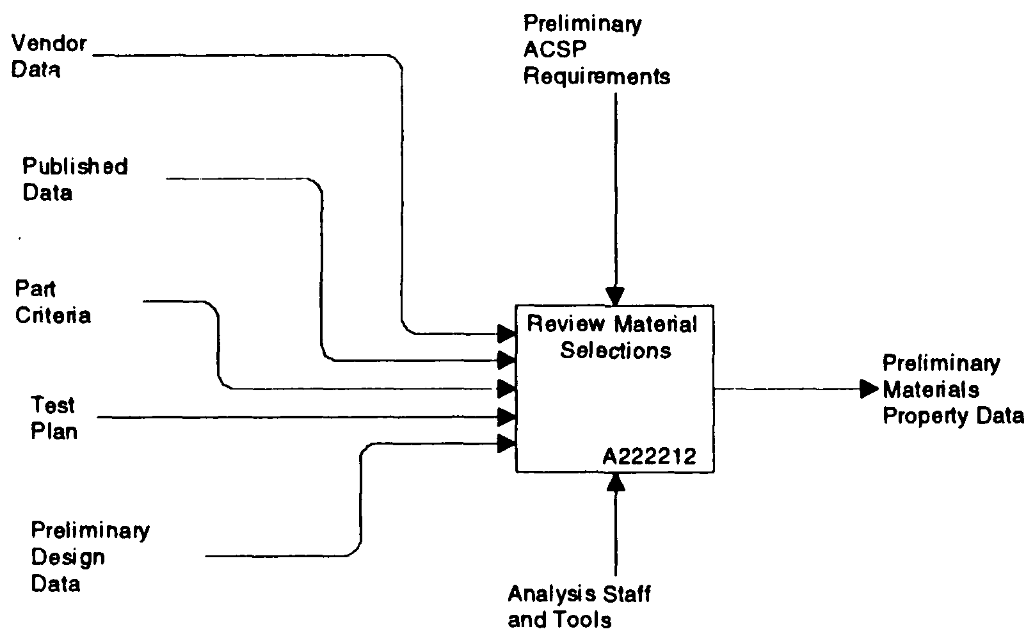
Process Interactions:

- Prelim. Cross-Funct. Eng. Reqs.
  These are the preliminary ACSP cross-functional engineering requirements.

- Prelim. Build & QA Reqs.
  These are the preliminary ACSP build & QA requirements that are deemed to affect the ACSP structure.

- Prelim. Logistics Supp. Reqs.
  These are the preliminary reliability and maintainability requirements that are deemed to affect the ACSP structure.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team ... Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
			X	DRAFT		PUBLICATION	
	NODE: A22221	TITLE:					



A-22221:

Activities:

A222212 Review ACSP Material Selections
Survey appropriate materials with the aim of selecting a composite or homogeneous material considering available data and performing tests as necessary.

Inputs:

I1 Vendor Data
Materials data supplied by the Vendor supplying the material(s).

I2 Published Data
Materials data available from published journals and reports.

I3 Part Criteria
Preliminary design and performance criteria.

I4 Test Plan
A plan developed to describe the testing process of the material that is being tested.

I5 Preliminary Design Data
The preliminary design geometry and associated ply boundaries, orientations, stiffener spacing and orientation, core placement and orientation, properties and stacking sequences.

Controls:

C1 Preliminary ACSP Requirements
The preliminary structural performance criteria for an ACSP.

Outputs:

O1 Preliminary Materials Data
All of the data needed to describe the physical responses of a composite material or its plies.

Mechanisms:

M1 Analysis Staff and Tools
The analysis staff and the hand (e.g. handbooks) and computerized tools (e.g. finite element analysis programs, various detail analysis programs) that aid the performance of composite structural analysis.

Process Interactions:

(None)

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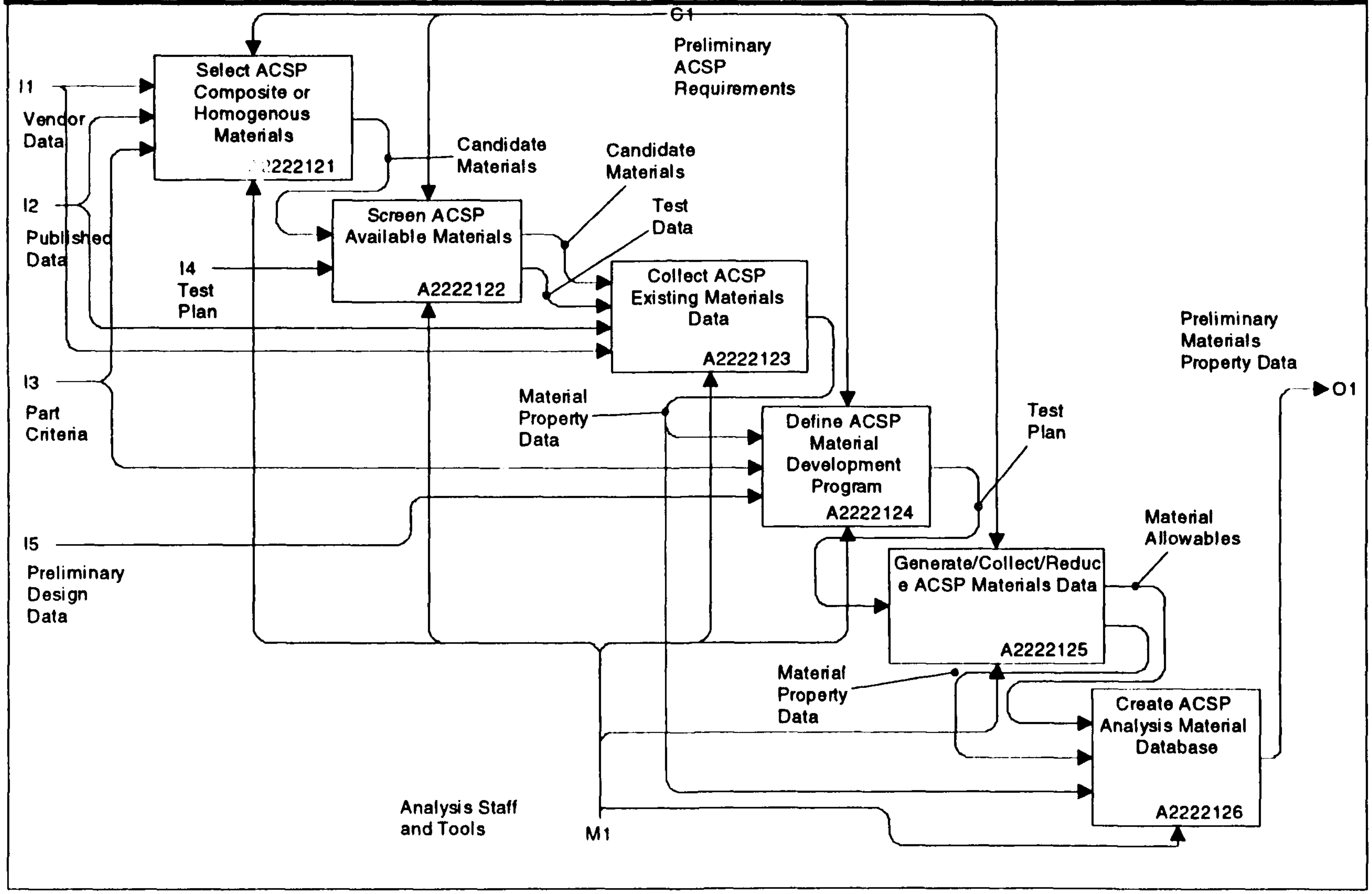
			X	DRAFT		PUBLICATION	
	NODE: A222212	TITLE: Review Material Selections					



A-222212: Review Material Selections

Activities:

A2222121 Select ACSP Composite or Homogeneous Material
Use weight, cost and structural performance criteria to select a composite or homogeneous material.

A2222122 Screen ACSP Available Materials
Use cost and structural performance criteria to screen available materials.

A2222123 Collect ACSP Existing Material Data
Collect existing data needed to support baseline and trade analyses, and the definition of design criteria.

A2222124 Define ACSP Material Development Program
Define a material development and coupon test program to collect the materials data that is not already in existence.

A2222125 Generate/Collect/Reduce ACSP Material Test Data
Perform a development and coupon test program to collect the materials data that is not already in existence.

A2222126 Create ACSP Analysis Materials Database
Create the information structure for an Analysis Materials Property Database, and supporting software as necessary. Load the new and existing collected materials test data into the database.

Inputs:

I1 Vendor Data
Materials data supplied by the Vendor supplying the material(s).

I2 Published Data
Materials data available from published journals and reports.

I3 Part Criteria
Preliminary design and performance criteria.

I4 Test Plan
A plan developed to describe the testing process of the material that is being tested.

I5 Preliminary Design Data
The preliminary design geometry and associated ply boundaries, orientations, stiffener spacing and orientation, core placement and orientation, properties and stacking sequences.

Controls:

C1 Preliminary ACSP Requirements
The preliminary structural performance criteria for an ACSP.

Outputs:

O1 Preliminary Materials Data
All of the data needed to describe the physical responses of a composite material or its plies.

Mechanisms:

M1 Analysis Staff and Tools
The analysis staff and the hand (e.g. handbooks) and computerized tools (e.g. finite element analysis programs, various detail analysis programs) that aid the performance of composite structural analysis.

Process Interactions:

- Candidate Materials
  The materials initially selected for the preliminary design and analysis of the ACSP
- Test Data
  Data resulting from structural tests of an ACSP.
- Test Plan
  A plan developed to describe the testing process of the test part.
- Material Allowables
  The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.
- Material Property Data
  All of the data needed to describe the physical responses of a composite material or its plies.

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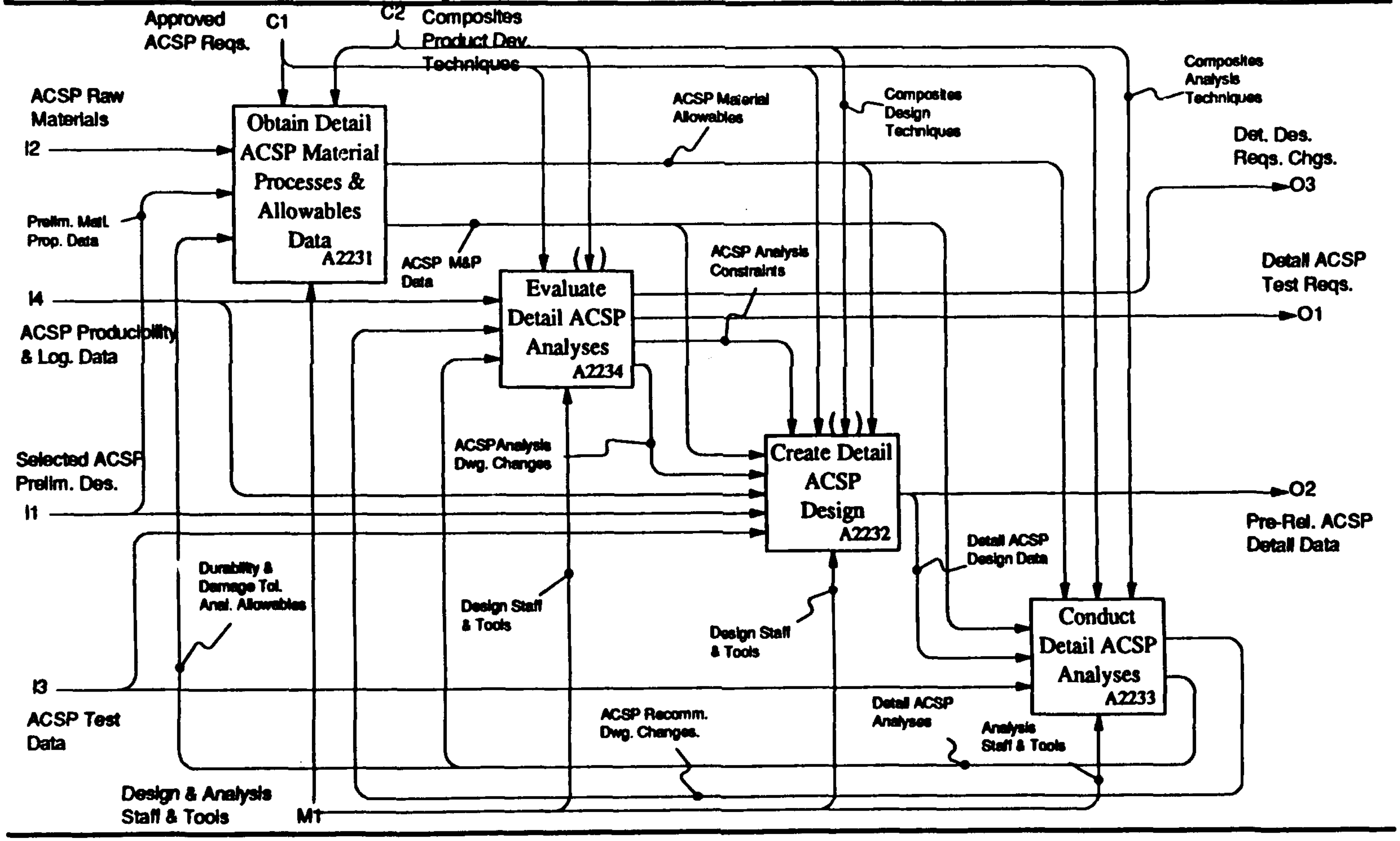
			X	DRAFT		PUBLICATION	
	NODE: A223	TITLE: Perform ACSP Detail Design & Analysis					



7

A223:Perform ACSP Detail Design & Analysis

Activities:

A2231 Obtain Detail ACSP Material Processes & Allowables Data
Obtain the detail ACSP Material Processes data that is unique to the composite materials. Obtain the Mechanical Allowables of representative sections of the ACSP.

A2232 Evaluate Detail ACSP Analyses
Evaluate all the detail ACSP analyses done to substantiate the weight, static, dynamic & thermal analysis; damage tolerance and producibility.

A2233 Create Detail ACSP Design
Create the detail ACSP design based on inputs from the preliminary design phase and detail concurrent analyses.

A2234 Conduct Detail ACSP Analyses
Conduct the detail ACSP structural analyses based on design loads from the weight, static, dynamic and thermal environments.

Inputs:

I1 Selected ACSP Prelim. Des.
The ACSP preliminary design selected from the various concepts that were traded, is now reached for the details design phase.

- Prelim. Matl. Prop. Data
  The preliminary ACSP material property data as developed in the preliminary design phase.

I2 ACSP Raw Materials
All of the raw materials as received from the material supplier. These are for the composite items of the ACSP.

I3 ACSP Test Data
All of the ACSP test data from the structural verification test of the ACSP and its components.

I4 ACSP Producibility & Log, Data
The ACSP producibility and logistics data is derived from the various manufacturing, maintainability and in-field product support studies of the ACSP.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

C2 Composites Product Development Techniques
The standard product development techniques for composites involve the standard design, analysis, and build procedures and specifications.

- Composites Design Techniques
  The standard composites design techniques involve the modeling, drawing, tolerancing and note attachment techniques that facilitate design development.

- Composites Analysis Techniques
  The standard composites analysis techniques involve the unique composite analysis algorithms for dealing with shapes and composite materials of the ACSP

Outputs:

O1 Detail ACSP Test Requirements
These are the detail ACSP test requirements based on the preliminary detail and analysis of the ACSP.

O2 Detail ACSP Design Data
The detail ASCP design data consists of all the models, drawings and parts list that make up the ACSP.

O3 Detail Design Requirement Changes
The detail design requirements changes based on the analysis, produce and maintainability results.

Mechanisms:

M1 Design & Analysis Staff & Tools

These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

- ACSP M&P Data
  This is all the necessary materials and processes data for the composite materials that make up the ACSP.

- Detail ACSP Design Data
  The detail ACSP design data consists of all the models, drawings and parts list that make up the ACSP.

- Detail ACSP Analyses
  All the detail structural analyses of the ACSP for the weight, static, dynamic and thermal conditions.

- ACSP Analysis Constraints
  The detail analysis done on the ACSP has developed strength limits for the ACSP.

- ACSP Analysis Dwg. Changes
  The changes that are recommended due to the analysis is reflected as redline marks to the design drawings.

- ACSP Recomm. Dwg. Changes
  As a result of the detail analysis of the ACSP drawing changes are recommended in order to meet the design load conditions.

- ACSP Material Allowables
  The ACSP material allowables are the structural strength characteristics of representative material and shape combination of composite items within an ACSP.

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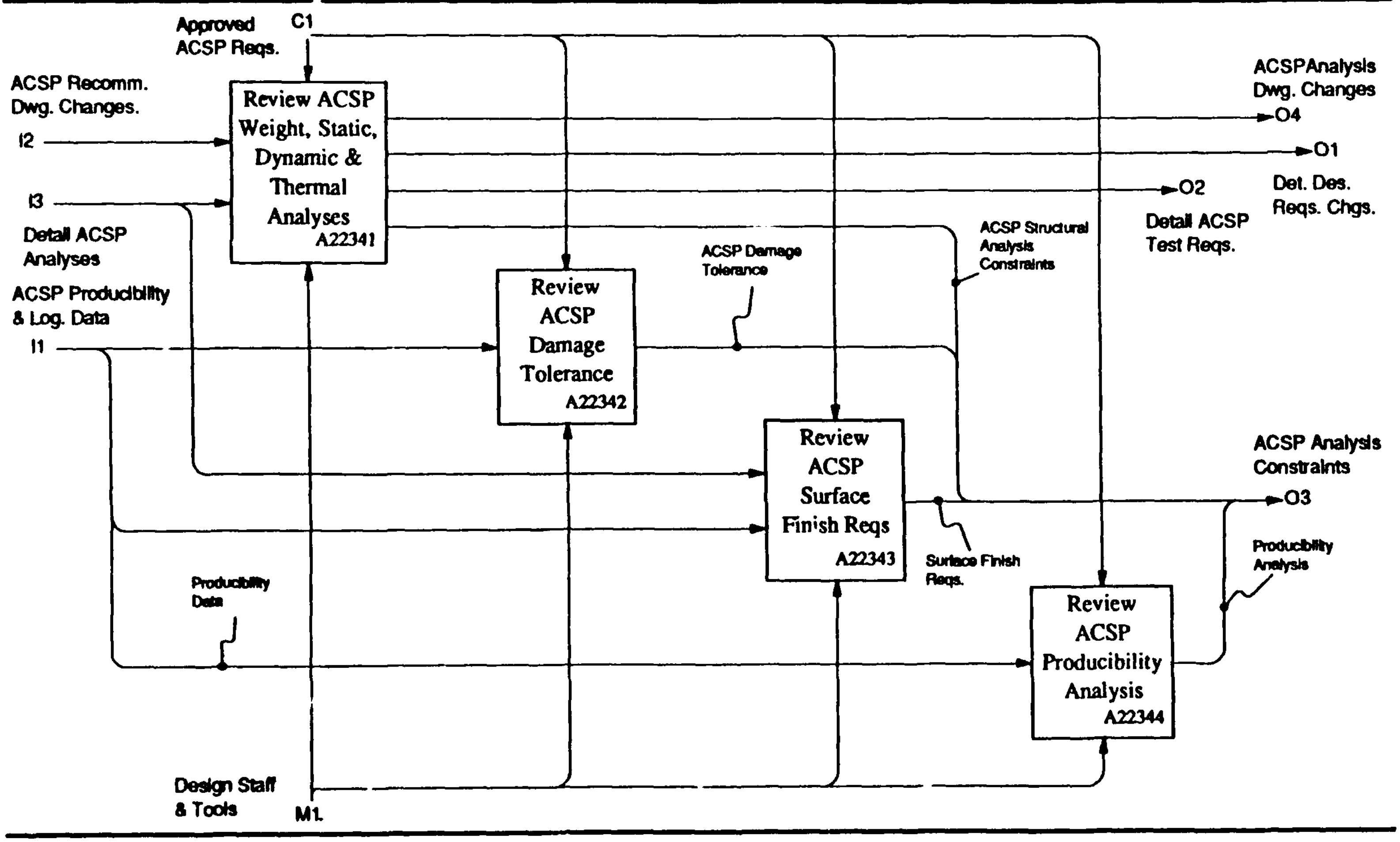
Boeing GD & LTV	NODE: A2234	TITLE: Evaluate Detail ACSP Analyses			



76

A2234:Evaluate Detail ACSP Analyses

Activities:

A22341 Review ACSP Weight, Static, Dynamic & Thermal
Review all the detail structural analyses for the ACSP due to weight, static, dynamic and thermal load environments.

A22342 Review ACSP Damage Tolerance
Review the ACSP damage tolerance environments as dictated by manufacturing handling and in-field maintenance and use.

A22343 Review ACSP Surface Finish Reqs.
Review the ACSP surface finish requirements as dictated by aerodynamic, fit-up and strength constraints.

A22344 Review ACSP Producibility Analysis
Review the various ACSP producibility studies done by manufacturing on the sequence and tools necessary for the ACSP.

Inputs:

I1 ACSP Producibility & Log. Data
The ACSP produce and logistics data is derived from the various manufacturing, maintainability and in-field product support studies of the ACSP.

- Producibility Data
  The ACSP producibility data shows the manufacturing sequences necessary to produce the ACSP with the available tools and processes.

I2 ACSP Recomm. Dwg. Changes
As a result of the detail analysis of the ACSP, drawing changes are recommended in order to meet the design load conditions.

I3 Detail ACSP Analyses
All the detail structural analyses of the ACSP for the weight, static, dynamic and thermal conditions.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 Detail Design Requirement Changes
The detail design requirements changes based on the analysis, produce and maintainability results.

O2 Detail ACSP Test Requirements
These are the detail ACSP test requirements based on the preliminary detail and analysis of the ACSP.

O4 ACSP Analysis Dwg. Changes
The changes that are recommended due to the analysis is reflected as redline marks to the design drawings.

O3 ACSP Analysis Constraints
The detail analysis done on the ACSP has developed strength limits for the ACSP.

- Surface Finish Reqs.
  The specific surface finish smoothness of the ACSP as required to meet aerodynamic, fit-up or strength requirements.
- ACSP Damage Tolerance
  The ACSP damage tolerance takes the form of minimum thickness potting or weight of the ACSP that will survive manufacturing handling in-field maintenance and use.
- ACSP Structural Analysis Constraints
  The structural analysis done on the ACSP has developed strength limits for the ACSP.
- Producibility Analysis
  The ACSP producibility analysis is that manufacturing sequence of tools and processes that have been reviewed to be feasible to make the ACSP.

Mechanisms:

M1 Design & Analysis Staff & Tools

These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

(None)

CREATE DETAIL ACSP DESIGN

DESIGN INDENTURED LIST

- **A2232 Create Detail ACSP Design**
  - A22321 Collect Baseline ACSP Design Data
  - A22322 Build ACSP model/drawing tree
  - **A22323 Prepare ACSP models & drawings**
    - A223231 Select ACSP model/drafting system
    - **A223232 Create ACSP geometry Layouts & Models**
      - **A2232321 Receive and Review ACSP Geometry Data**
        - A22323211 Receive and Review ACSP Paper Geometry Data
        - A22323212 Receive and Verify ACSP CAD Translated Data
        - A22323213 Receive and Review ACSP Native CAD Data
      - **A2232322 Build ACSP Layouts and Models**
        - A22323221 Select ACSP Construction Plans
        - A22323222 Create ACSP 2-D Envelope
        - A22323223 Create ACSP 3-D Wireframe
        - A22323224 Create ACSP Surface
        - A22323225 Create ACSP Solid
      - A2232323 Prepare ACSP Data for Transfer
    - **A223233 Create ACSP Drawing Data**
      - A2232331 Create ACSP tooling interface drawings
      - **A2232332 Prepare Detail ACSP Composite Item Drawings**
        - A22323321 Select ACSP views
        - **A22323322 Prepare ACSP detail views**
          - A223233221 Resolve ACSP interfaces and joints
          - A223233222 Resolve ACSP size panel issues
          - A223233223 Create ACSP data
        - A22323323 Attach ACSP dimensions and tolerances
        - A22323324 Attach ACSP composites engineering
        - A22323325 Prepare & coordinate ACSP signature process
      - A2232333 Prepare & Integrate ACSP assembly drawings
      - A2232334 Prepare & release ACSP AMRs
      - A2232335 Prepare ACSP installation drawings
    - A223234 Update ACSP drawing & model data
  - A22324 Build ACSP parts list
  - A22325 Perform ACSP CDR functions

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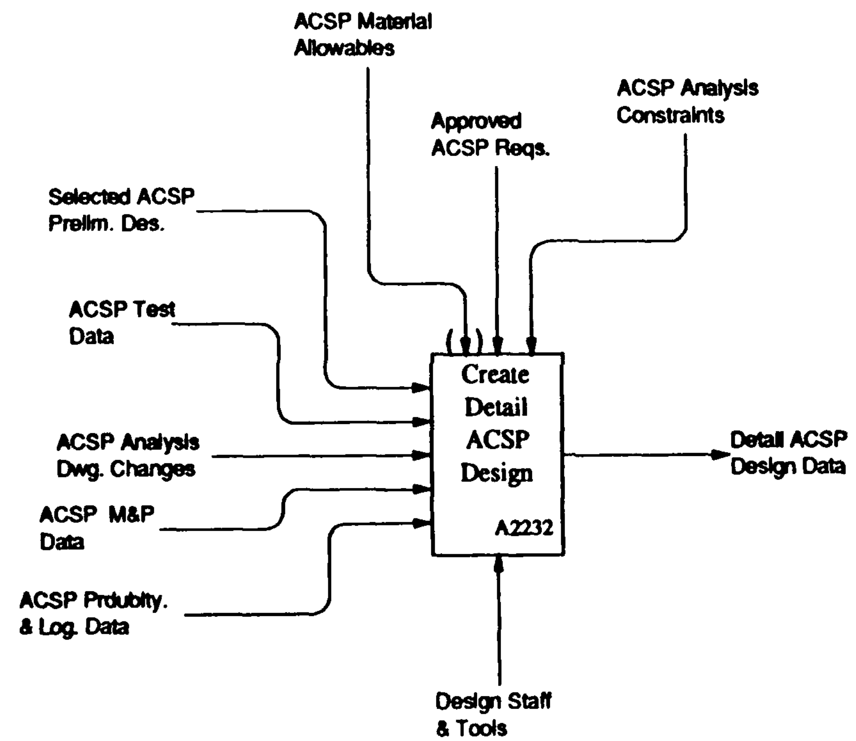
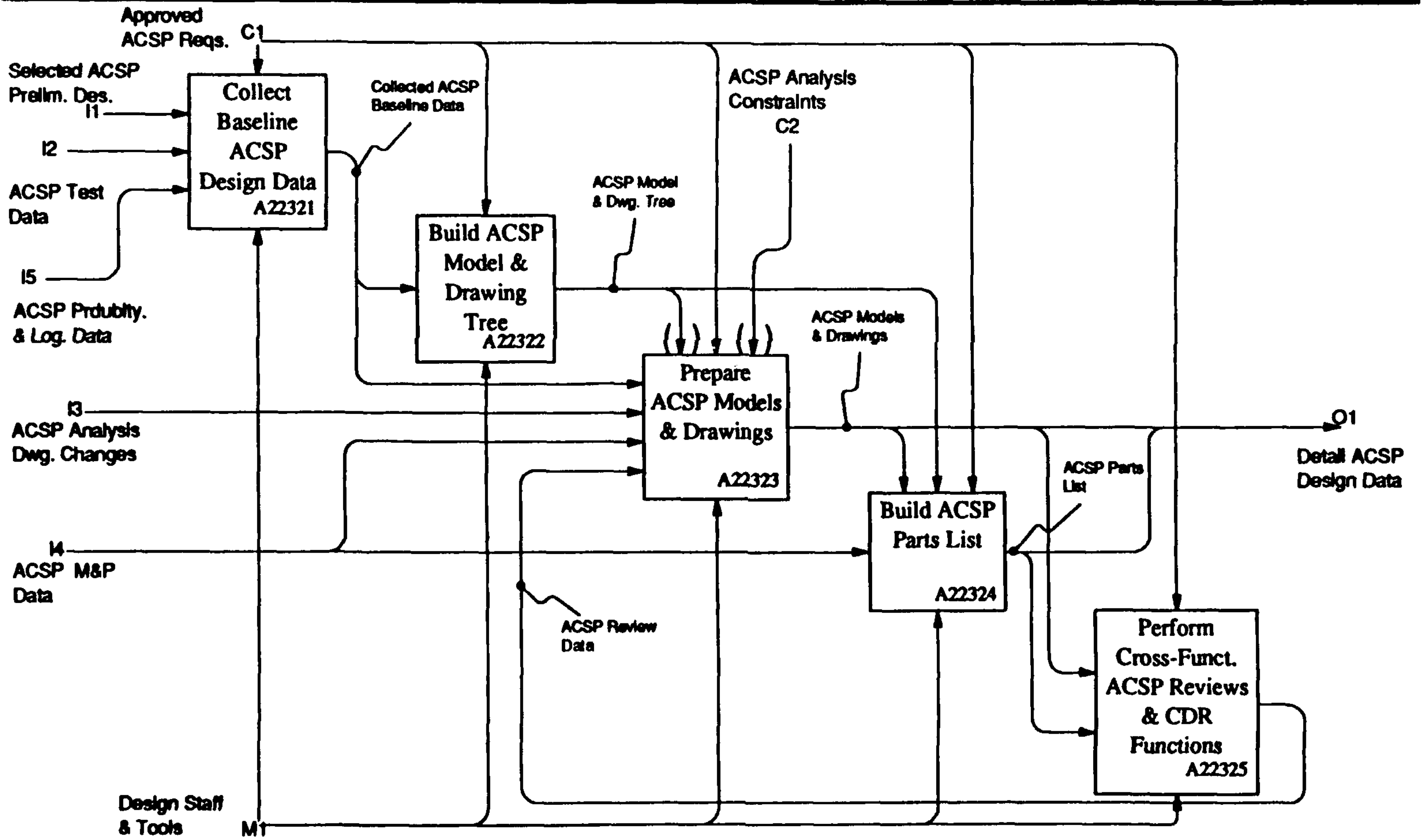
	NODE: A223	TITLE:			



USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV			X	DRAFT		PUBLICATION	
	NODE: A2232	TITLE: Create Detail ACSP Design					



56

A2232: Create Detail ACSP Design

Activities:

A22321 **Collect Baseline ACSP Design Data**
The collections of baseline ACSP design data includes the selected preliminary design, test data, producibility and maintainability studies.

A22322 **Build ASCP Model & Drawing Tree**
A model/drawing tree is developed for the ACSP, which specifies the combinations of composite items used to create the ACSP.

A22323 **Prepare ACSP Model & Drawings**
Prepare the ACSP models and drawings using the reviewed design inputs and creating the necessary outputs for other functional use.

A22324 **Build ACSP Parts List**
Build an ACSP parts list of the components that make up the ACSP.

A22325 **Perform Cross-Funct. ACSP Reviews & CDR Functions**
Perform the necessary cross-functional and customer design reviews to support the critical design review phase.

Inputs:

I1 **Selected ACSP Prelim. Des.**
The ACSP preliminary design selected from the various concepts that were traded, is now reached for the details design phase.

I2 **ACSP Test Data**
All of the ACSP test data from the structural verification test of the ACSP and its components.

I3 **ACSP Analysis Dwg. Changes**
The changes that are recommended due to the analysis is reflected as red line marks to the design drawings.

I4 **ACSP M&P Data**
This is all the necessary materials and processes data for the composite materials that make up the ACSP.

I5 **ACSP Produce & Log. Data**
The ACSP producibility and logistics data is derived from the various manufacturing, maintainability and in-field product support studies of the ACSP.

Controls:

C1 **Approved ACSP Reqs.**
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

C2 **ACSP Analysis Constraints**
The detail analysis done on the ACSP has developed strength limits for the ACSP.

Outputs:

O1 **Detail ACSP Design Data**
The detail ASCP design data consists of all the models, drawings and parts list that make up the ACSP.

- ACSP Models & Drawings
  The ACSP models and drawings are all the geometric and associated engineering notes for the ACSP.
- ACSP Parts List
  ACSP parts list consist of all the material and subcomponents that make up the ACSP list.

Mechanisms:

M1 **Design & Analysis Staff & Tools**
These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

- Collect ACSP Baseline Data
  The collected ACSP baseline data consists of the required input geometry, system and drawing data.

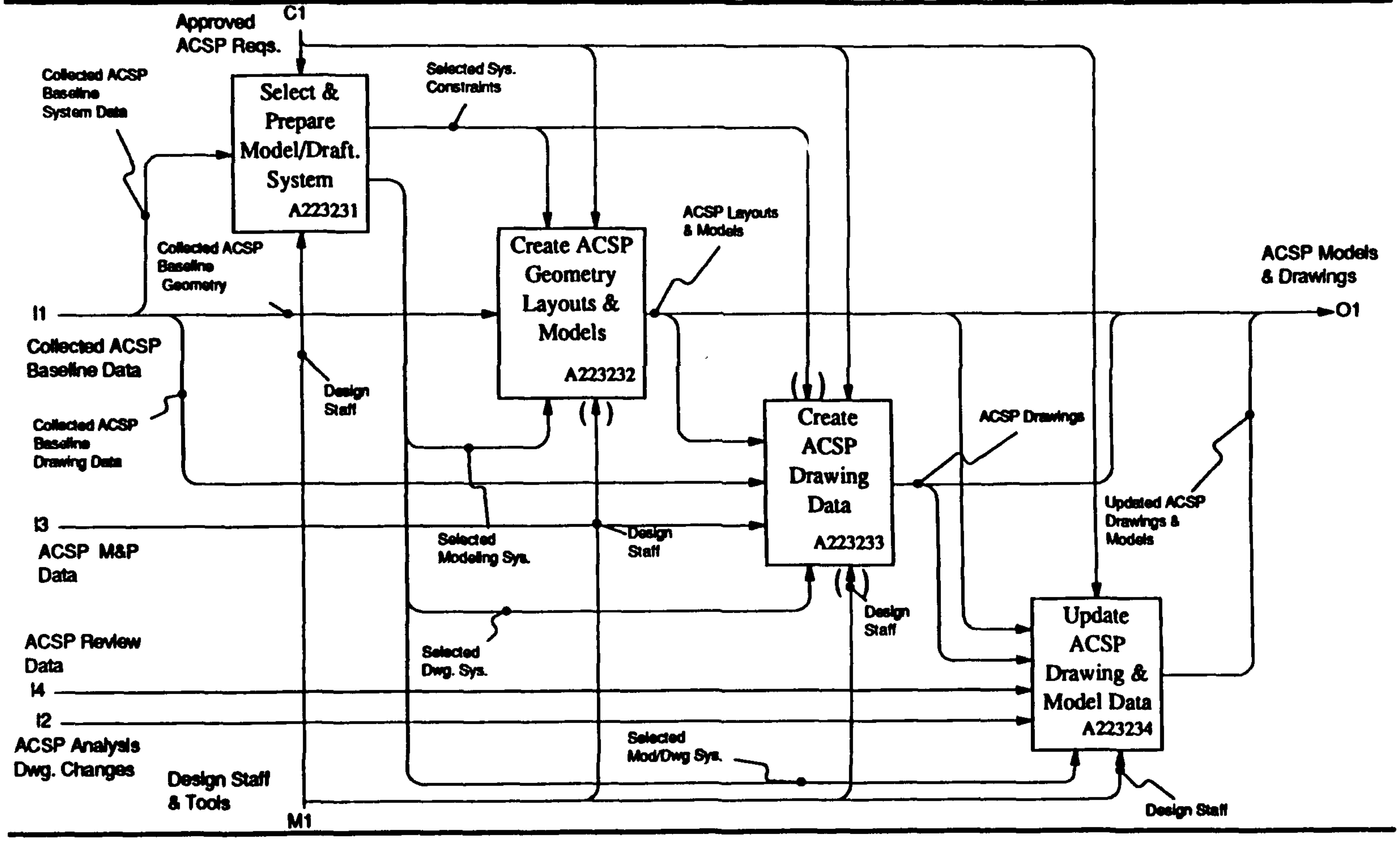
- ACSP Model & Dwg. Tree
  The ACSP model and drawing tree consist of a hierarchical relationship of the drawings and models of the ACSP.

- ACSP Models & Drawings
  The ACSP models and drawings are all the geometric and associated engineering notes for the ACSP.

- ACSP Review Data
  ACSP review data is that which has been done in the company and customer reviews of the design of the ACSP.

- ACSP Parts List
  ACSP parts list consist of all the material and subcomponents that make up the ACSP list.

USED AT: Boeing GD & LTV	AUTHOR: PAS -C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00	[ ] WORKING [X] DRAFT	[ ] RECOMMENDED [ ] PUBLICATION	CONTEXT:
	NODE: A22323	TITLE: Prepare ACSP Models & Drawings			



90

A22323: Prepare ACSP Models and Drawings

Activities:

A223231 Select & Prepare Model/Draft System
Select and prepare the modeling/drafting geometry system to be used for the detail design phase of the ACSP.

A223232 Create ASCP Geometry Layouts & Models
Create all of the necessary ACSP geometry layouts and models from the various inputs and prepare the data for transfer to other functions.

A223233 Create ACSP Drawing Data
Create all the ACSP drawing data from the geometry and engineering specifications inputs using the selected systems.

A223234 Update ACSP Drawing & Model Data
Update the ACSP drawings and models based on the changes to the ACSP.

Inputs:

I1 Collected ACSP Baseline Data
The collected ACSP baseline data consists of the required input geometry, system, and drawing data.

- Collected ACSP Baseline Geometry
  This collected ACSP baseline geometry consists of all the selected ACSP preliminary design geometry and other associated producibility and maintainability studies geometry.

- Collected ACSP Baseline System Data
  This collected baseline system data for ACSP development are the standard features of the available CAD systems hardware and software configurations.

- Collected ACSP Baseline Drawing Data
  This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

I2 ACSP Analysis Dwg. Changes
The changes that are recommended due to the analysis is reflected as red line marks to the design drawings.

I3 ACSP M&P Data
This is all the necessary materials and processes data for the composite materials that make up the ACSP.

I4 ACSP Review Data
ACSP review data is that which has been done in the company and customer reviews of the design of the ACSP.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 ACSP Models & Drawings
ASCP models and drawings are all the geometry and associated notes for the ACSP.

- ACSP Layouts & Models
  The ACSP layouts and models consist of all the two dimensional geometry required of the design.

- Updated ACSP Models & Drawings
  The updated ACSP drawings and models are those that have incorporated the most recent design changes.

- ACSP Drawings
  ACSP drawings are all the necessary component and assembly drawings. They include tooling interface, component, assembly and installation drawings.

Mechanisms:

M1 Design & Analysis Staff & Tools
These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools

These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

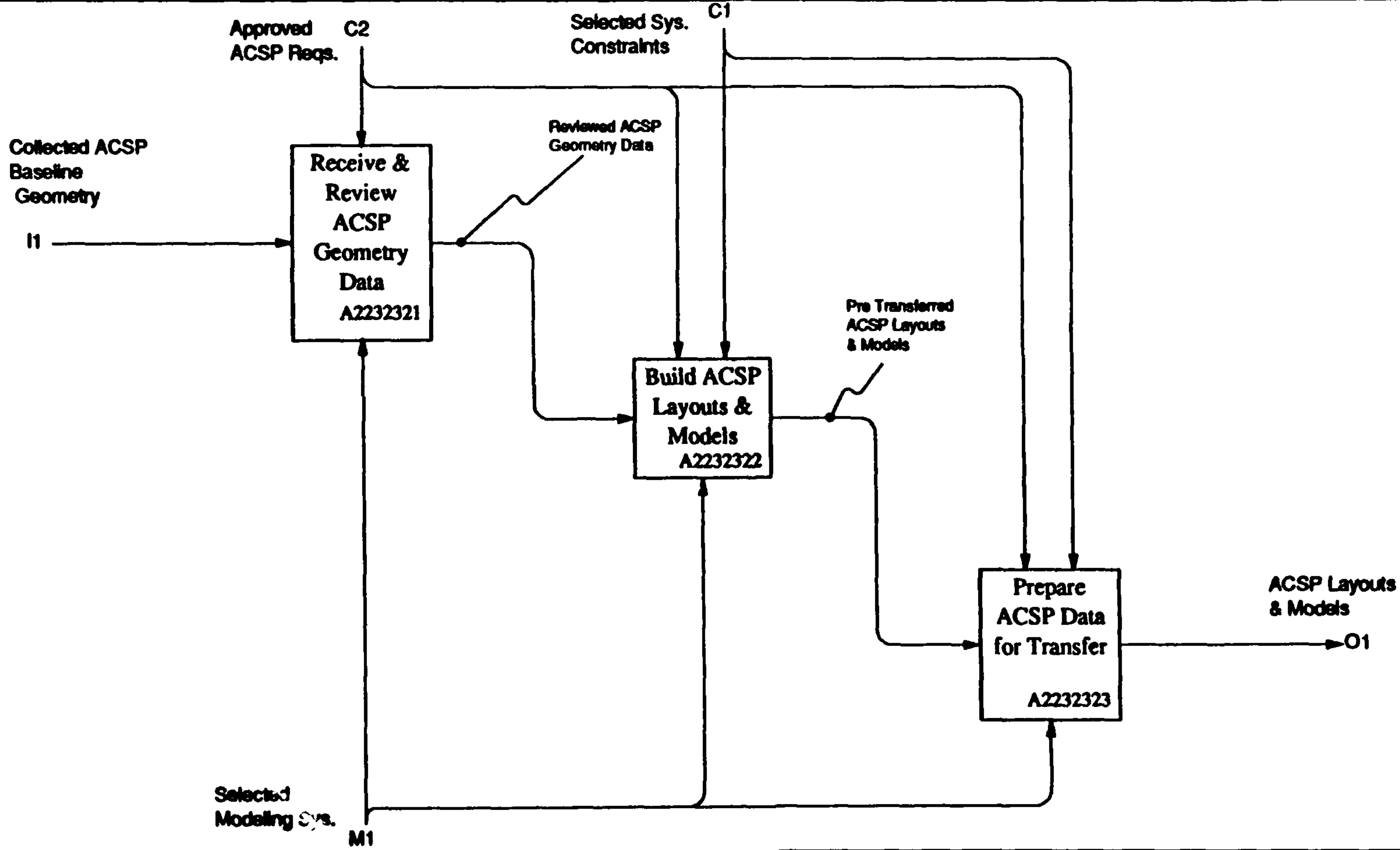
- ACSP Layouts & Models
  The ACSP layouts and models consist of all the two dimensional geometry required of the design.

- Selected Sys. Constraints
  The selected system constraints are the inherent drafting or modeling technique constraints of the design toolset.

- Selected Modeling Sys.
  This is the selected modeling system needed to support the detail design development.

- ACSP Drawings
  ACSP drawings are all the necessary component and assembly drawings. They include tooling interface, component, assembly and installation drawings.

USED AT:	AUTHOR: PAS -C Team & Experts	DATE: 11/25/91		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A223232	TITLE: Create ACSP Geometry Layouts & Models					



94

A223232: Create ACSP Geometry Layouts & Models

Activities:

A2232321 **Receive & Review ACSP Geometry Data**
Receive and review all the different forms (paper, translated, native) of ACSP geometry data that will be necessary to develop the ACSP geometry.

A2232322 **Build ASCP Layouts & Models**
Build the ACSP layouts and models using the various geometry inputs.

A2232323 **Prepare ACSP Data for Transfer**
Prepare the ACSP data transfer to other functions in either paper, translated or native form to other functions.

Inputs:

I1 **Collected ACSP Baseline Data**
The collected ACSP baseline data consists of the required input geometry, system, and drawing data.

- Collected ACSP Baseline Geometry
  This collected ACSP baseline geometry consists of all the selected ACSP preliminary design geometry and other associated producibility and maintainability studies geometry.

- Collected ACSP Baseline System Data
  This collected baseline system data for ACSP development are the standard features of the available CAD systems hardware and software configurations.

- Collected ACSP Baseline Drawing Data
  This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

Controls:

C1 **Selected Sys. Constraints**
The selected system constraints are the inherent drafting or modeling technique constraints of the design toolset.

C2 **Approved ACSP Reqs.**
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 • **ACSP Layouts & Models**
The ACSP layouts and models consist of all the two dimensional geometry required of the design.

Mechanisms:

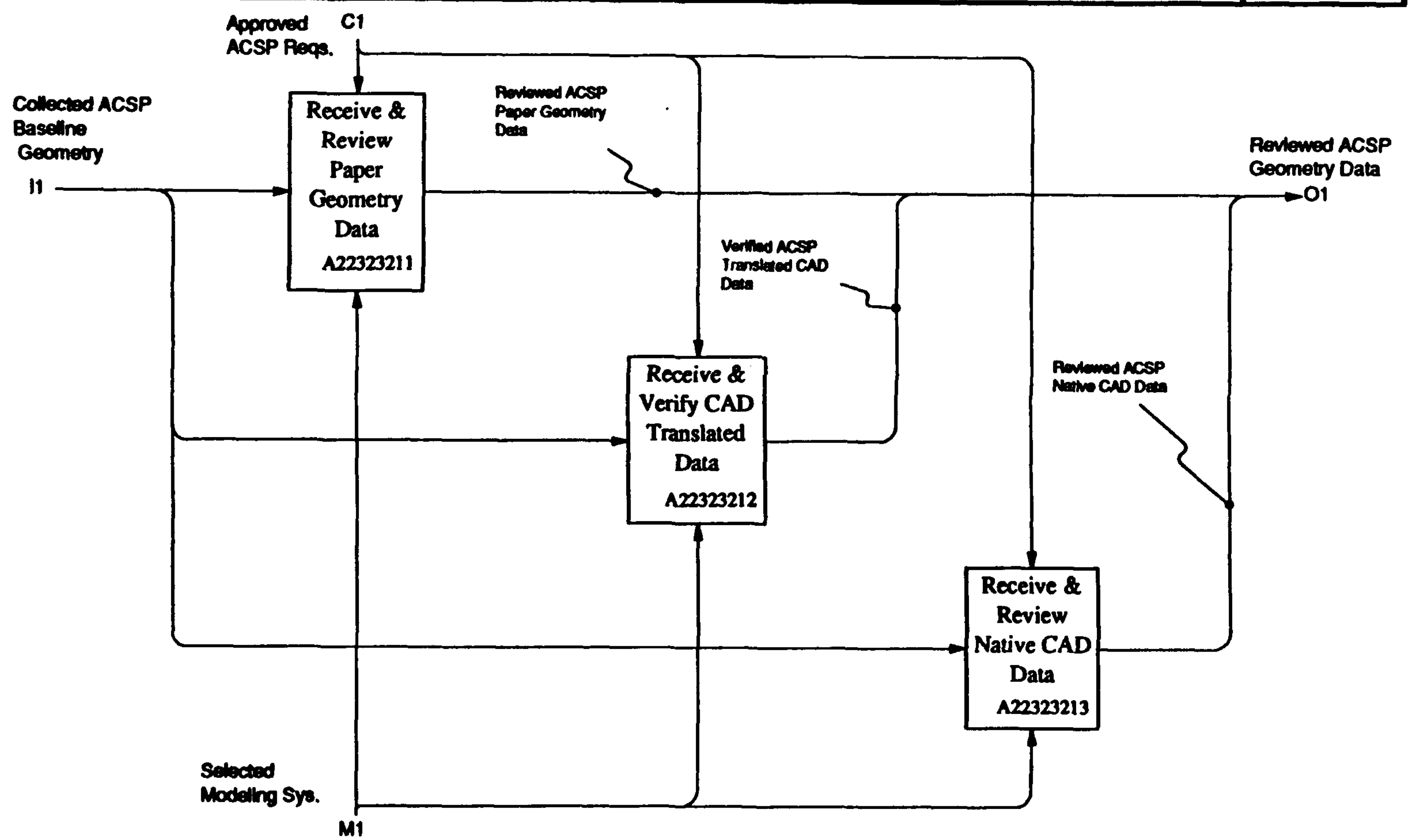
M1 **Selected Modeling Sys.**
This is the selected modeling system needed to support the detail design development.

Process Interactions:

- **Reviewed ACSP Geometry Data**
  The reviewed ACSP geometry data is the geometry that was received from other sources and is deemed necessary for the ACSP geometry development.

- **ACSP Layouts & Models**
  The ACSP layouts and models consist of all the two dimensional geometry required of the design.

USED AT: Boeing GD & LTV	AUTHOR: PAS -C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A2232321	TITLE: Receive & Review ACSP Geometry Data			



96

A2232321: Receive & Review ACSP Geometry Data

Activities:

A22323211 Receive & Review Paper Geometry Data
Receive and review all the paper geometry data necessary to develop ACSP geometry.

A22323212 Receive & Verify CAD Translated Data
Receive & verify the translated CAD data as delivered from other CAD systems.

A22323213 Receive & Review Native CAD Data
Receive and review the native CAD data as received from similar CAD systems.

Inputs:

I1 Collected ACSP Baseline Geometry
The collected ACSP baseline data consists of all the selected ACSP preliminary design geometry and other associated producibility and maintainability studies geometry.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 Reviewed ACSP Geometry Data
Reviewed ACSP geometry data consists of paper, translated and native CAD data.

- Reviewed ACSP Paper Geometry Data
  The reviewed ACSP paper geometry data is the data necessary to develop the ACSP geometry.
- Verified ACSP Translated CAD Data
  The verified ACSP translated data is the geometry and text that was successfully translated and received in by the CAD toolset, and is now used to develop the ACSP geometry.
- Reviewed ACSP Native CAD Data
  The reviewed ACSP native CAD data is the geometry and test that was reviewed after received from a similar CAD system.

Mechanisms:

M1 Selected Modeling Sys.
This is the selected modeling system needed to support the detail design development.

Process Interactions:

(None)

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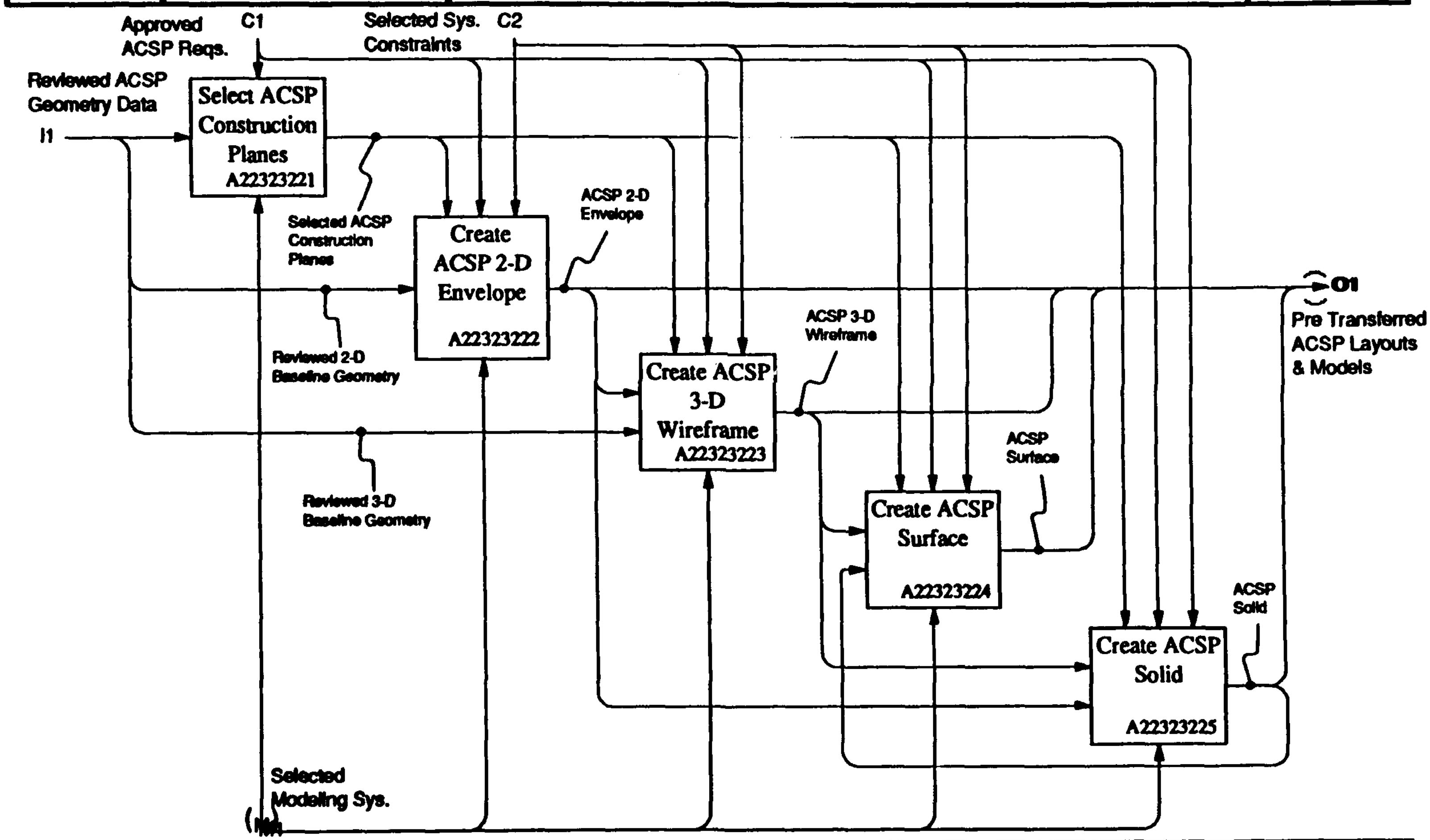
	NODE: A2232322	TITLE: Build ACSP Layouts & Models			



98

A2232322: Build ACSP Layouts & Models

Activities:

A22323221 Select ACSP Construction Planes
Select the ACSP construction planes that render the desired views of the ACSP for top, front, side or cross-section details.

A22323222 Create ACSP 2-D Envelope
Create the ACSP 2-D envelope geometry using conventional 2-D drawing entities within the selected construction planes.

A22323223 Create ACSP 3-D Wireframe
Create the ACSP 3-D wireframe geometry using conventional 3-D drawing entities.

A22323224 Create ACSP Surface
Create the ACSP *surface geometry using conventional surface modeling entities.*

A22323225 Create ACSP Solid
Create the ACSP *solid geometry using conventional or specialized solid entities.*

Inputs:

I1 Reviewed ACSP Geometry Data
The reviewed ACSP geometry data is the geometry that is deemed necessary to support the geometry development of the ACSP.

- Reviewed 2-D Baseline Geometry
  The reviewed 2-D baseline geometry is the data that was received from other sources than deemed necessary to support the geometry development by the ACSP.

- Reviewed 3-D Baseline Geometry
  The reviewed 3-D baseline geometry is the data that was received from other sources than deemed necessary to support the geometry development by the ACSP.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

C2 Selected Sys. Constraints
The selected system constraints are the inherent drafting or modeling technique constraints of the design toolset.

Outputs:

O1 ACSP Layouts & Models
The ACSP layouts and models consist of all the two dimensional geometry required of the design.

- ACSP 2-D Envelope
  The ACSP 2-D envelope consists of just the 2-axis view of the ACSP.

- ACSP 3-D Wireframe
  The ACSP 3-D wireframe consists of a 3-D view of the ACSCP features using conventional 3-D modeling entities that show the edges.

- ACSP Surface
  The ACSP surface consists of the graphical rendering of the boundary faces of the part.

- ACSP Solid
  The ACSP solid is the graphical and physical electronic representation of the ACSP.

Mechanisms:

M1 Selected Modeling Sys.
This is the selected modeling system needed to support the detail design development.

Process Interactions:

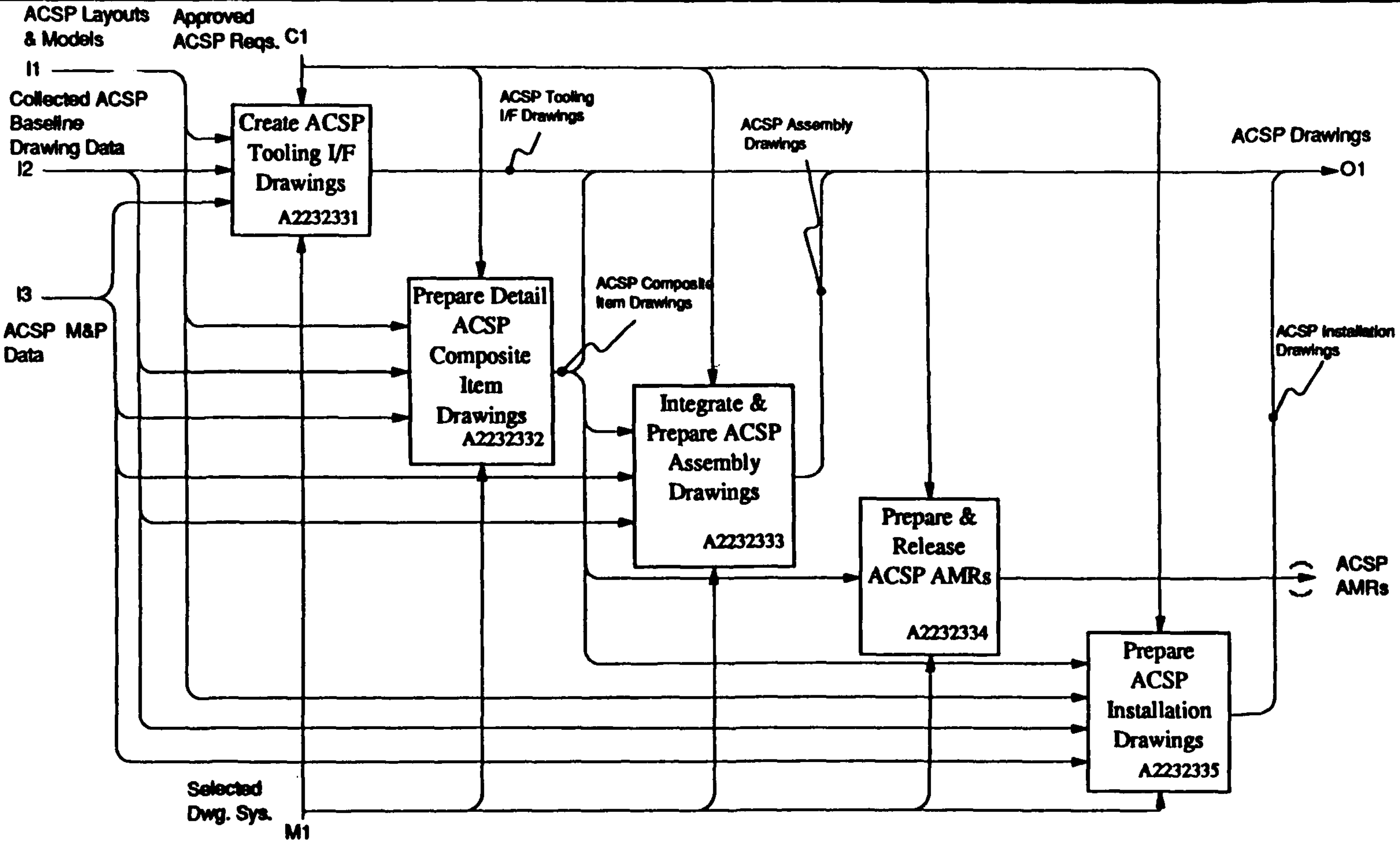
- Selected ACSP Construction Planes
  The selected construction planes are the associated cartesian axes of the top, front, side or cross-section views desired of the ACSP.

- ACSP 2-D Envelope
  The ACSP 2-D envelope consists of just the 2-axis view of the ACSP.

- ACSP 3-D Wireframe
  The ACSP 3-D wireframe consists of a 3-D view of the ACSP features using conventional 3-D modeling entities that show the edges.

- ACSP Solid
  The ACSP solid is the graphical and physical electronic representation of the ACSP.

USED AT: Boeing GD & LTV	AUTHOR: PAS -C Team & Experts PROJECT: PAS-C	DATE: 11/25/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION
	NODE: A223233	TITLE: Create ACSP Drawing Data		CONTEXT:



A223233: Create ACSP Drawing Data

Activities:

A2232331 Create ACSP Tooling I/F Drawings
This is the creation of all the ACSP Inner Mold Line (IML) and/or Outer Mold Line (OML) tool interfaces to the ACSP. These drawings are also referred to as envelope drawings.

A2232332 Prepare Detail ACSP Composite Item Drawings
This activity is the preparation of the detail composite item's drawings that make-up the ACSP.

A2232333 Integrate & Prepare ACSP Assembly Drawings
Integrate and prepare all of the composite items that make up the ACSP into an integrated assembly drawing.

A2232334 Prepare & Release ACSP AMRs
All of the Advanced Material Requests (AMR)s needed by the engineering function are prepared and released so the material necessary for the build cycle will be on dock.

A2232335 Prepare ACSP Installation Drawings
All of the other subassemblies or assemblies that the ACSP is used on are shown on specific installation drawings.

Inputs:

I1 ACSP Layouts & Models
The ACSP layouts and models consist of all the two dimensional geometry required of the design.

I2 Collected ACSP Baseline Drawing Data
This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

I3 ACSP M&P Data
This is all the necessary materials and processes data for the composite materials that make up the ACSP.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 ACSP Drawings
The ACSP drawings consists of the tooling interface, composite item, installation and assembly drawings.

- ACSP Tooling I/F Drawings
  The ACSP tooling interface drawings consist of the Inner Mold Line (IML) and/or Outer Mold Line (OML) of the tool interfaces to the ACSP.
- ACSP Composite Item Drawings
  The ACSP composite item drawings are all the design details of the subcomponents and assembly of the ACSP.
- ACSP Installation Drawings
  The ACSP installation drawings show how the ACSP is installed in other assemblies.
- ACSP Assembly Drawings
  ACSP Assembly drawings show how the composite component items are *positioned in an assembly.*

O2 ACSP AMRs
The ACSP AMRs are the Advanced Material Requests by engineering of ACSP components that will be on dock for the build cycle.

Mechanisms:

M1 Selected Modeling Sys.

This is the selected modeling system needed to support the detail design development.

Process Interactions:

- ACSP Composite Item Drawings

  The ACSP composite item drawings are all the design details of the subcomponents and assembly of the ACSP.

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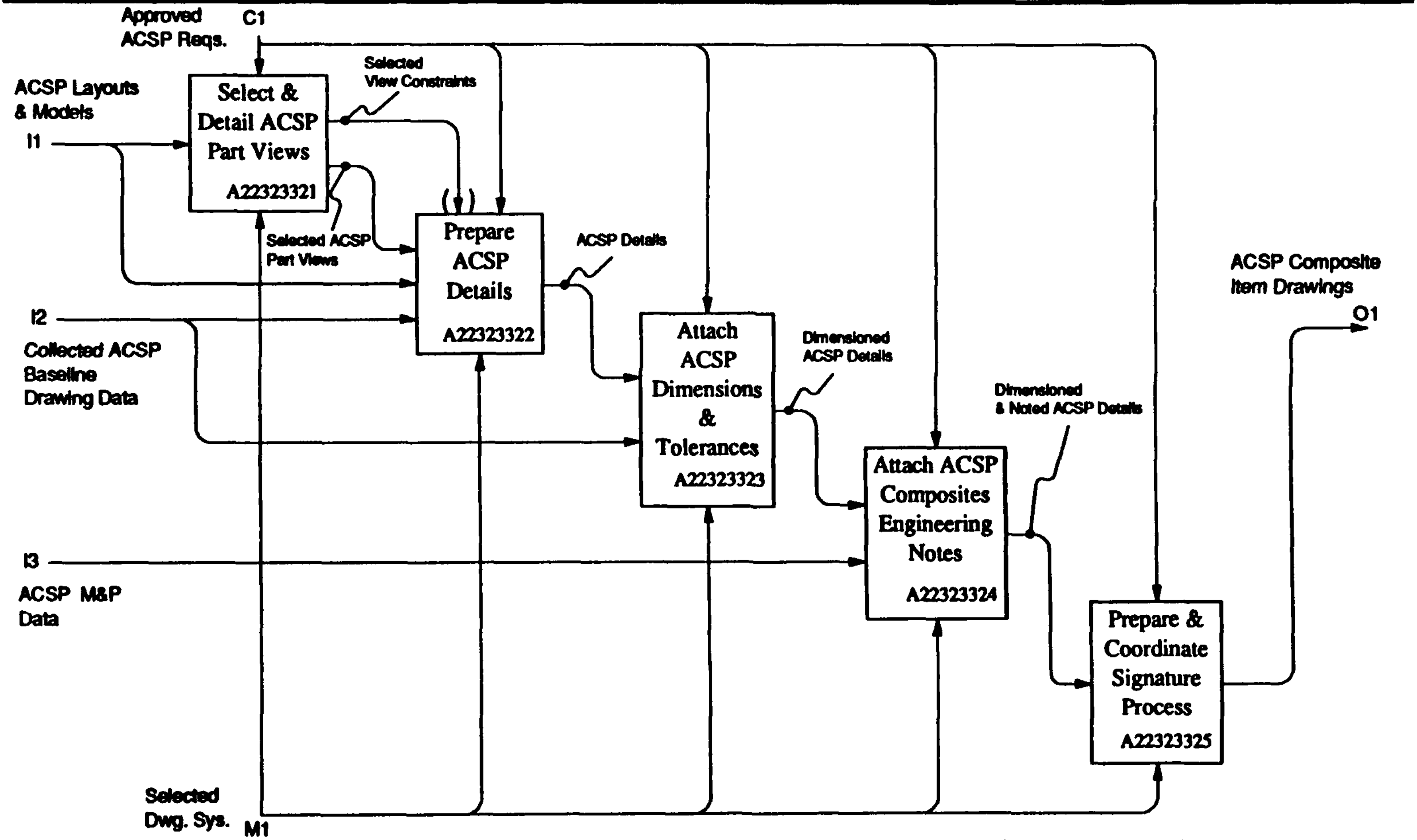
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A2232332	TITLE: Prepare Detail ACSP Composite Item Drawings					



104

A2232332: Prepare ACSP Detail Composite Item Drawings

Activities:

A22323321 Select & Detail ACSP Part Views
Select and detail the necessary ACSP part views based on the typical top, front, side and cross-sections needed to show the desired features.

A22323322 Prepare Detail ACSP Composite Item Drawings
Prepare the ACSP details to resolve the interfaces, joints, panel size and the development of the detail composite drawings.

A22323323 Attach ACSP Dimensions & Tolerances
Attach all the necessary dimensions and tolerances to the geometry of the drawing.

A22323324 Attach ACSP Composites Engineering Notes
Attach all the ACSP composites engineering notes on the drawing. They specify process specifications, change notes, material callouts, etc.

A22323325 Prepare & Coordinate Signature Process
All of the responsible reviews of the drawings, as noted on the signature block, are coordinated for their specific functional reviews and signature.

Inputs:

I1 ACSP Layouts & Models
The ACSP layouts and models consist of all the two dimensional geometry required of the design.

I2 Collected ACSP Baseline Drawing Data
This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

I3 ACSP M&P Data
This is all the necessary materials and processes data for the composite materials that make up the ACSP.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 ACSP Composite Item Drawings
These are detailed drawings that depict all the geometric and associated engineering notes for the composite items that make up an ACSP.

Mechanisms:

M1 Selected Drwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- Selected ACSP Part Views
  The selected ACSP part views are the top, front, side and cross-section views necessary to show the geometric features.
- Selected View Constraints
  The selected view constraints are the construction planes of the top, front, side or cross-sections that are location dependent.
- ACSP Details
  ACSP details consists of all the design data required of the ACSP as a result of mating interfaces and joints, and internal design, and manufacturing considerations. This all takes the form of drawings and parts lists that are distributed to other user functions.
- Dimensioned ACSP Details
  These are the dimensioned and toleranced ACSP details as they would appear on the drawing.
- Dimensioned & Noted ACSP Details
  These are the dimensioned, toleranced and noted ACSP details as they would appear on a completed detail drawing.

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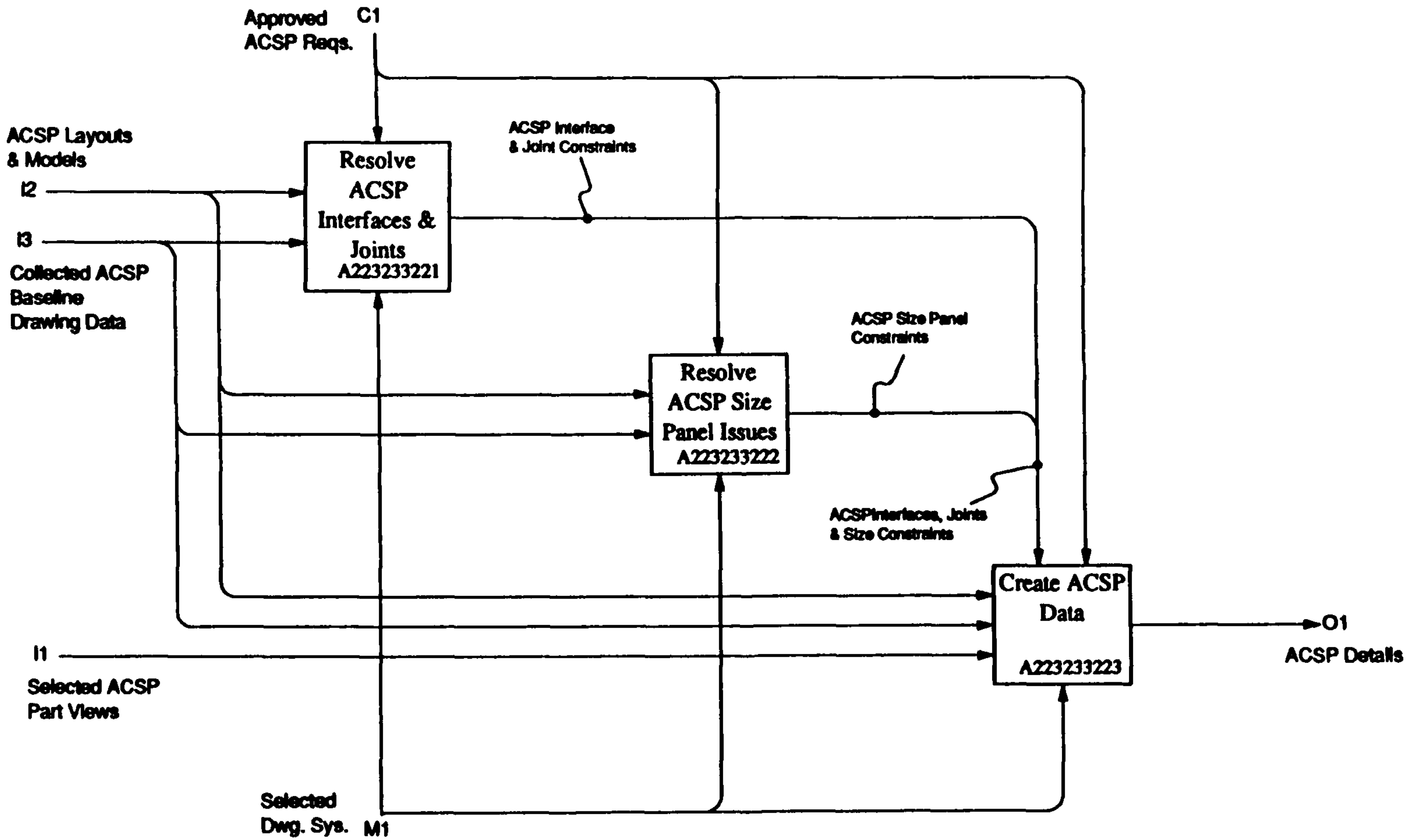
	NODE: A22323322	TITLE: Prepare ACSP Details				



10V

A22323322: Prepare ACSP Details

Activities:

A223233221 Resolve ACSP Interfaces & Joints
Resolve all the mating interfaces to the ACSP that involve mechanical or bonded joints. Look at space constraints, attachment issues and material compatibility.

A223233222 Resolve ACSP Panel Size Issues
Resolve all the size issues regarding the ACSP panel size due to tooling constraints and general design rules regarding the length and width features.

A223233223 Create ACSP Data
Create all the ACSP design data necessary for detail composite drawings and associated engineering notes.

A22323324 Attach ACSP Composites Engineering Notes
Attach all the ACSP composites engineering notes on the drawing. They specify process specifications, change notes, material callouts, etc.

A22323325 Prepare & Coordinate Signature Process
All of the responsible reviews of the drawings, as noted on the signature block, are coordinated for their specific functional reviews and signature.

Inputs:

I1 Selected ACSP Part Views
The selected ACSP part views are the top, front, side and cross-section views necessary to show the geometric features.

I2 ACSP Layouts & Models
The ACSP layouts and models consist of all the two dimensional geometry required of the design.

I3 Collected ACSP Baseline Drawing Data
This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

Controls:

C1 Approved ACSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 ACSP Details
ACSP details consists of all the design data required of the ACSP as a result of mating interfaces and joints, and internal design, and manufacturing considerations. This all takes the form of drawings and parts lists that are distributed to other user functions.

Mechanisms:

M1 Selected Drwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- ACSP Interface & Joint Constraints
  The ACSP interface and joint constraints are from the mating part's envelope and joint configuration.

- ACSP Panel Size Constraints
  The ACSP panel size constraints are the tooling and design constraints that dictate the length and width features of the ACSP.

CONDUCT DETAIL ACSP ANALYSIS

Analysis Indentured List

- **A2233 Conduct Detail ACSP Analysis**
  - A22331 Conduct ACSP Static Loads Analysis
  - A22332 Conduct ACSP Thermal Analysis
  - A22333 Conduct ACSP Dynamic Analysis
  - A22334 Conduct ACSP Mass Properties Analysis
  - **A22335 Conduct ACSP Static Stress Analysis**
    - A223351 Create ACSP Static Stress Analysis Decision Record
    - **A223352 Conduct ACSP Finite Element Analysis (FEA)**
      - **A2233521 Generate ACSP Finite Element Models**
        - **A22335211 Generate ACSP Node Geometry**
          - A223352111 Hand Generate ACSP Node Geometry
          - A223352112 Input ACSP Node Geometry from PDES/STEP Exchange File
          - A223352113 Create ACSP Node Geometry from Existing Geometry
        - A22335212 Generate and Assign ACSP Element Connectivities
        - **A22335213 Generate and Assign ACSP Element Attributes**
          - A223352131 Generate ACSP Geometric Attributes
          - A223352132 Generate ACSP Material Angles or Coordinate Systems
          - **A223352133 Generate/Import ACSP Material Properties**
            - A2233521331 Import ACSP Material Properties from PDES/STEP Exchange File
            - A2233521332 Import ACSP Material Properties from Analysis Materials Database
            - A2233521333 Generate ACSP Material Properties from Ply Properties, Stacking Sequence and Orientations
            - A2233521334 Input ACSP Anisotropic Material Property Matrices
            - A223352134 Assign ACSP Material, Geometric, Material Coordinate System/Angle Attributes to Elements
        - A22335214 Generate ACSP Graphical Finite Element Models Documentation
      - **A2233522 Generate ACSP Finite Element Analysis Environment and Controls**
        - A22335221 Set/Assign ACSP Boundary Constraints/Releases
        - A22335222 Generate/Assign ACSP Load Sets and Combinations
        - A22335223 Assign ACSP Factors of Safety, Durability/Damage Tolerance & Allowables
        - A22335224 Generate/Assign ACSP Analysis Output Control Requests
          - A223352241 Request ACSP Deflection Data Output
          - A223352242 Request ACSP Stress Data Output
          - A223352243 Request ACSP Strain Data Output
          - A223352244 Request ACSP Interlaminar Shear Data Output
          - A223352245 Request ACSP Reaction and Internal Load Data Output
          - A223352246 Request ACSP Generation/Output of Matrices
        - A22335225 Generate ACSP Analysis Procedure Controls
      - A2233523 Perform ACSP Mechanical/Thermo-Mechanical FEA
        - A22335231 Perform ACSP Linear Analysis
        - A22335232 Perform ACSP Nonlinear Stability Analysis
        - A22335233 Perform ACSP Nonlinear Material Analysis
        - A22335234 Perform ACSP Nonlinear Geometry Analysis

A22335235 Perform ACSP Combined Geometric and Material Nonlinear Analysis

A2233524 Create/Document ACSP Internal Loads/Stress Database

A22335241 Translate ACSP Data from FEA Solver

A22335242 Translate ACSP Data from PDES/STEP Exchange File

A22335243 Generate ACSP Textual Analysis Output Database Documentation

A22335244 Generate ACSP Graphical Analysis Output Database Documentation

A223353 Conduct ACSP Detail Stress Analysis

A2233531 Conduct ACSP Static Strength Analysis

A2233532 Conduct ACSP Fine Grid Finite Element Analysis

A22335321 Generate ACSP Fine Grid Finite Element Model from Coarse Grid Model

A22335322 Apply ACSP Loads/Boundary Conditions from Coarse Grid Model

A22335323 Perform ACSP Finite Element Analysis

A22335324 Calculate ACSP Margins of Safety Based upon Fine Grid Analysis Results

A22335325 Create ACSP Fine Grid Internal Loads/Stress Database Results

A223354 Plan ACSP Tests/Analyze Test Results

A2233541 Produce ACSP Test Part Configuration Documents

A2233542 Produce ACSP Test Plan

A2233543 Perform ACSP Test Surveillance, Validation and Data Review

A2233544 Produce ACSP Test Results Documentation and Feed Back Information to Design

A223355 Analyze ACSP Manufacturing Discrepancies

A223356 Feed Back ACSP Laminate Description, Ply Stacking Sequence and Orientation to Design

A22336 Conduct ACSP Durability and Damage Tolerance Analysis

A223361 Classify ACSP Parts into Safety of Flight/Fracture Critical and Others

A2233611 Apply ACSP Damage Tolerance Critical/Size to Safety of Flight/Fracture Critical ACSP

A22336111 Apply/Size ACSP Based on Scratches

A22336112 Apply/Size ACSP Based on Delaminations

A22336113 Apply/Size ACSP Based on Impacts

A22336114 Apply/Size ACSP Based on 1/4" Holes/Crack criteria

A2233612 Apply Durability and Environmental Threat Criteria to all other ACSPs

A223362 Guide ACSP Material Selection and Setting of Material Criteria

A2233621 ACSP Guide based on Stacking Sequence Optimization

A2233622 ACSP Guide based on Edge Delamination Criteria

A2233623 ACSP Guide based on Sub-Laminate Buckling Criteria

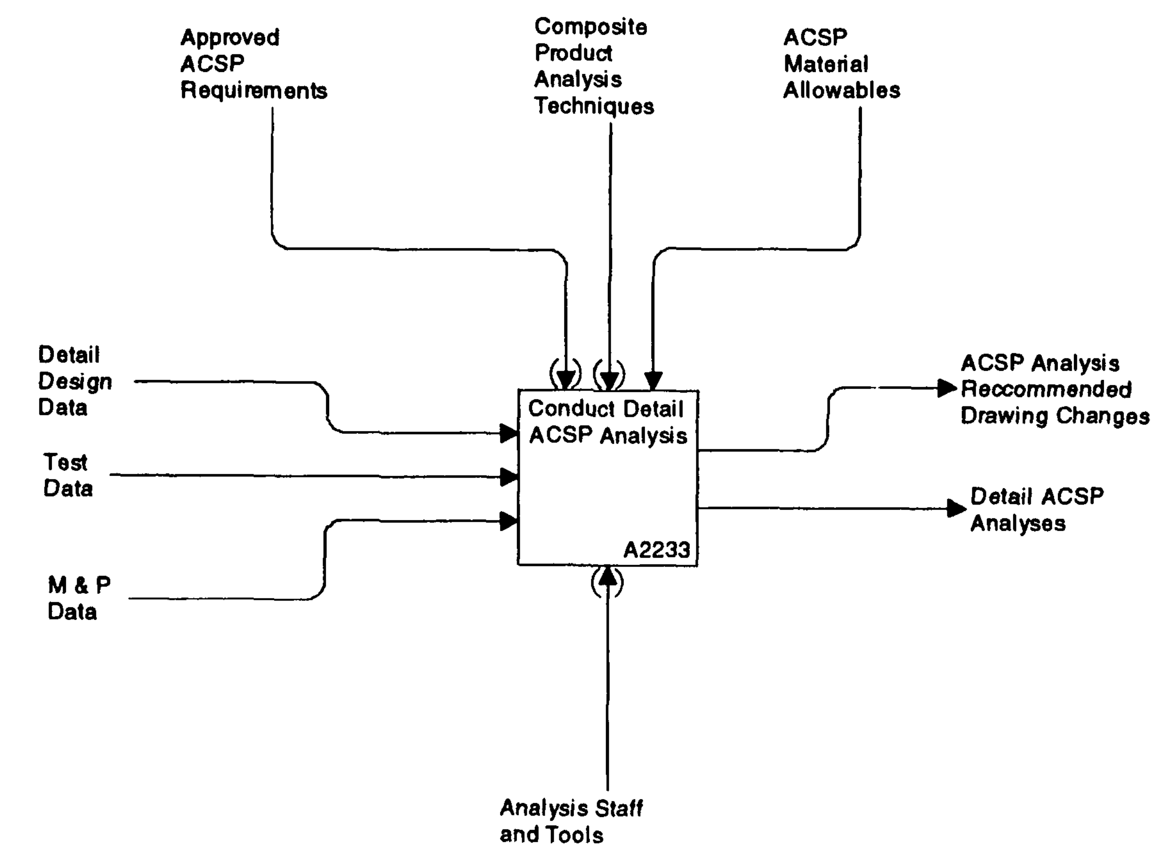
A2233624 ACSP Guide based on Design Details

A2233625 ACSP Guide based on Experimental Results/Validated Analysis Methods

A223363 Set ACSP Non-Destructive Inspection Allowables

A223364 Create ACSP Durability and Damage Tolerance Analysis Decision Record

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A223	TITLE:			



A-223:

Activities:

A2233 Conduct Detail ACSP Analysis
Conduct all of the necessary static, dynamic, thermal, and mass property analyses required for the ACSP.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 Test Data
Data resulting from structural tests of an ACSP.

I3 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

C2 Approved ACSP Requirements
The approved structural performance criteria for an ACSP.

C3 Composites Product Analysis Techniques
The hand and computerized techniques used to perform composite structural analyses.

Outputs:

O1 ACSP Analysis Recommended Drawing Changes
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

O2 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

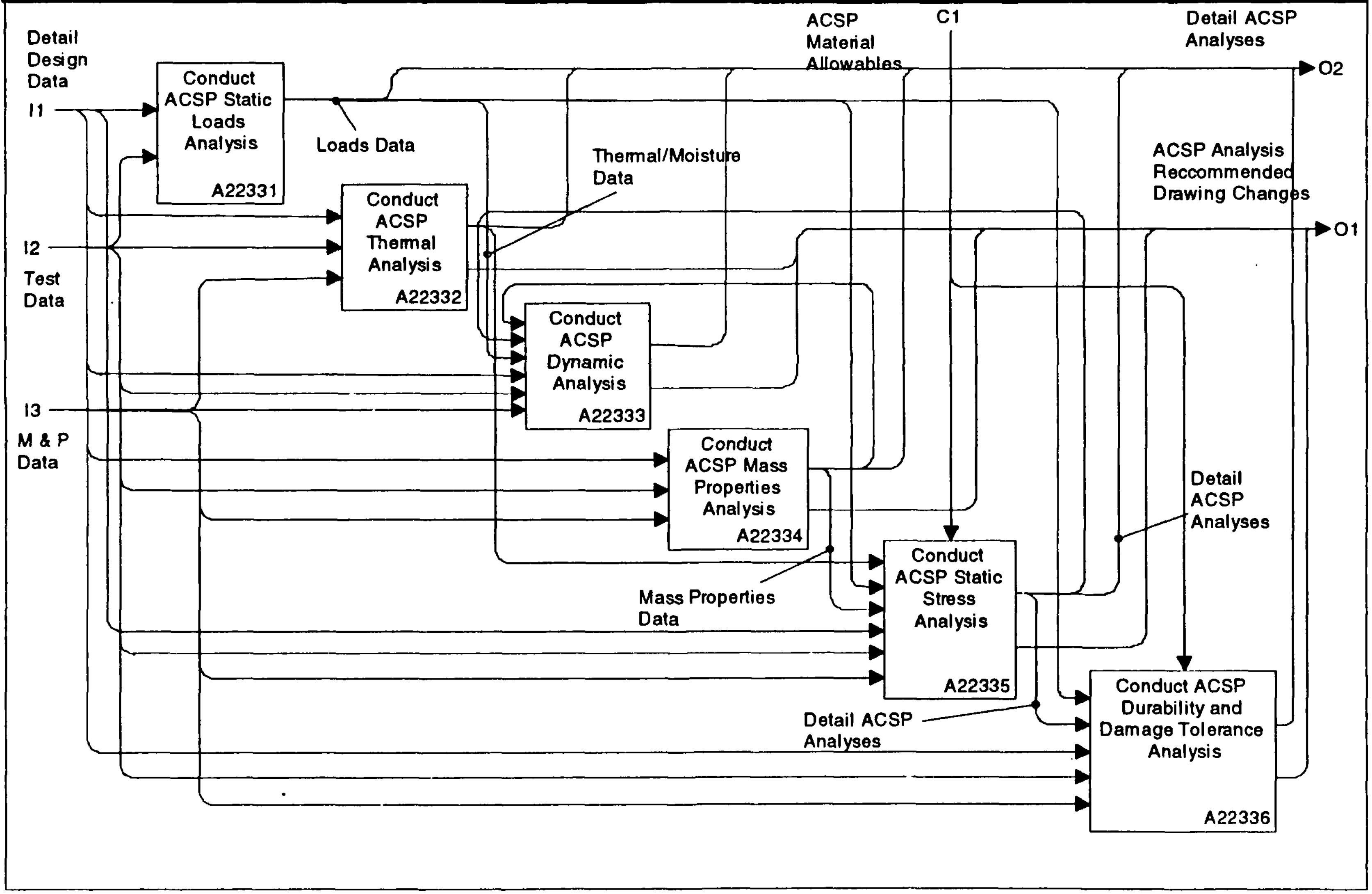
Mechanisms:

M1 Analysis Staff and Tools
The analysis staff and the hand (e.g. handbooks) and computerized tools (e.g. finite element analysis programs, various detail analysis programs) that aid the performance of composite structural analysis.

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
			I	DRAFT		PUBLICATION	
	NODE: A2233	TITLE: Conduct Detail ACSP Analysis					



A-2233: Conduct Detail ACSP Analysis

Activities:

A22331 **Conduct ACSP Static Loads Analysis**
Conduct analyses to calculate the all types of loading, such as aerodynamic, inertial, etc. This activity is not detailed as there is no specialized composite application.

A22332 **Conduct ACSP Thermal Analysis**
Conduct analyses to calculate thermal loads from such sources as aerodynamic heating and engine waste heat. This activity is not detailed as it is not applicable to the selected part family.

A22333 **Conduct ACSP Dynamic Analysis**
Conduct analyses to evaluate the dynamic response of the structural part. This activity is not detailed as it is not applicable to the selected part family.

A22334 **Conduct ACSP Mass Properties Analysis**
Conduct analyses to evaluate the total weight and mass distribution of the structural part. This activity is not detailed as there is no specialized composite application..

A22335 **Conduct ACSP Static Stress Analysis**
Stress analysis is a contractual requirement for ACSP structures to insure the integrity of the airframe during usage within operational limits.

A22336 **Conduct ACSP Durability and Damage Tolerance Analyses**
Conduct durability and damage tolerance analyses to classify parts into critical and otherwise, guide material and allowables selection, set non-destructive inspection criteria.

Inputs:

I1 **Detail Design Data**
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 **Test Data**
Data resulting from structural tests of an ACSP.

I3 **M & P Data**
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 **ACSP Material Allowables**
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 **ACSP Analysis Recommended Drawing Changes**
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

O2 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

Mechanisms:

(None)

Process Interactions:

- **Detail ACSP Analyses**
  All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.
- **Loads Data**
  The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.
- **Mass Properties Data**
  The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.
- **Thermal/Moisture Data**
  The thermal and moisture environment of the ACSP.

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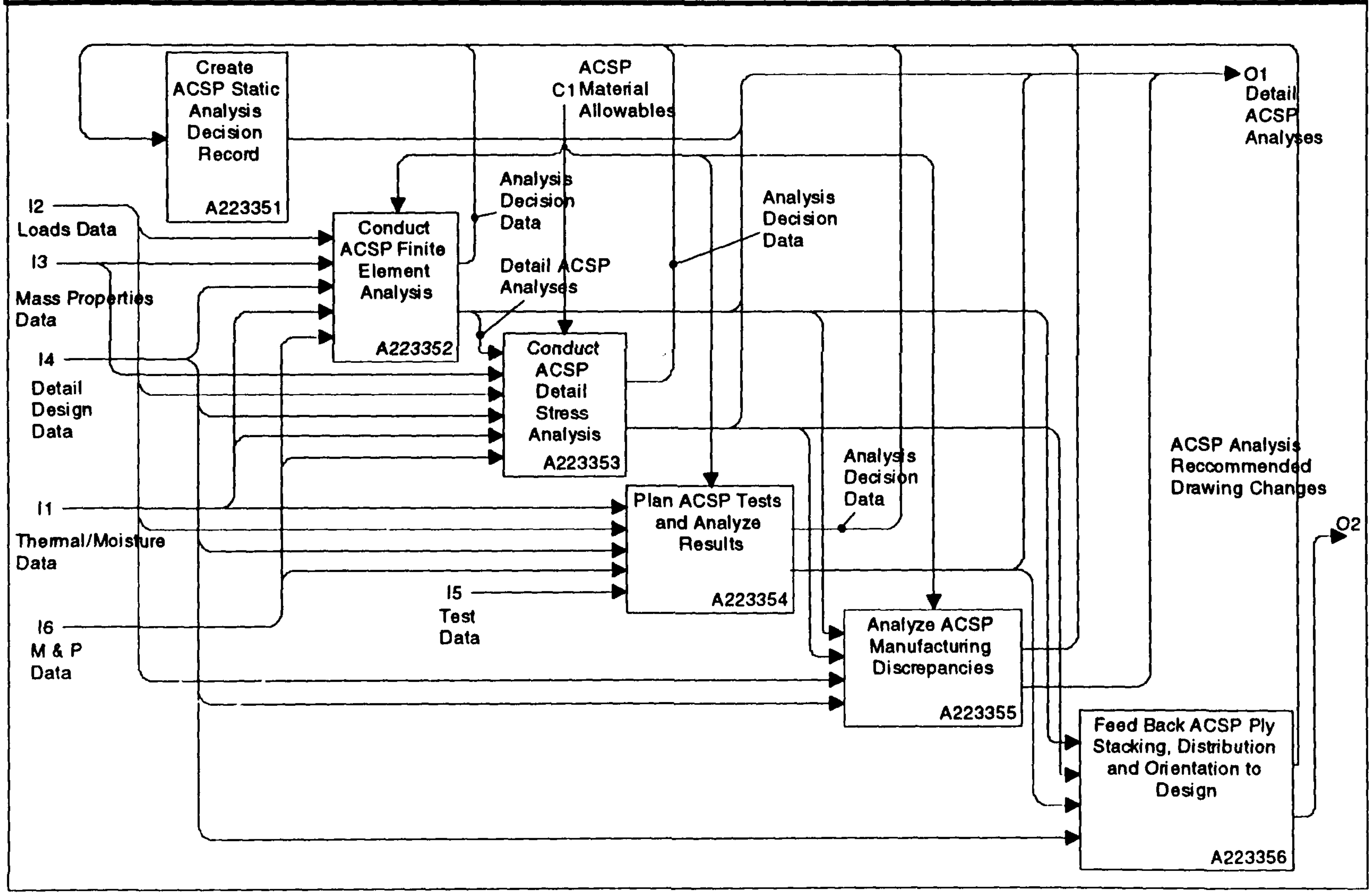
	NODE: A22335	TITLE: Conduct ACSP Static Stress Analysis			



A-22335: Conduct ACSP Static Stress Analysis

Activities:

A223351 **Create ACSP Static Analysis Decision Record**
Create a record of the decisions and idealizations made during the static stress analysis.

A223352 **Conduct ACSP Finite Element Analysis (FEA)**
Conduct static stress analysis using Finite Element Analysis techniques on digital computers.

A223353 **Conduct ACSP Detail Stress Analysis**
Conduct part detail stress analysis of part details such as fasteners and cutouts using handbook and automated methods. The internal loads/stress database or hand generated loads are used to supply the input data for these analyses. These analyses are used to support drawing signout, and final documentation.

A223354 **Plan ACSP Tests and Analyze Test Results**
Plan and analyze the output from element and sub-component structural test of the structural part to validate analyses.

A223355 **Analyze ACSP Manufacturing Discrepancies**
Inspect, gather analysis input data, research and apply analyses, end recommend and document the disposition of discrepant parts.

A223356 **Feed Back ACSP Laminate Description, Ply Stacking Sequence and Orientation to Design**
Feed back any changed laminate descriptions, ply stacking sequence and orientations to design.

Inputs:

I1 **Thermal/Moisture Data**
The thermal and moisture environment of the ACSP.

I2 **Loads Data**
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I3 **Mass Properties Data**
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

I4 **Detail Design Data**
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I5 **Test Data**
Data resulting from structural tests of an ACSP.

I6 **M & P Data**
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C **ACSP Material Allowables**
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

O2 **ACSP Analysis Recommended Drawing Changes**
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

Mechanisms:

(None)

Process Interactions:

- Analysis Decision Data
  The data that records the decisions and idealizations made during the stress analysis of the ACSP.

- Detail ACSP Analyses
  All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

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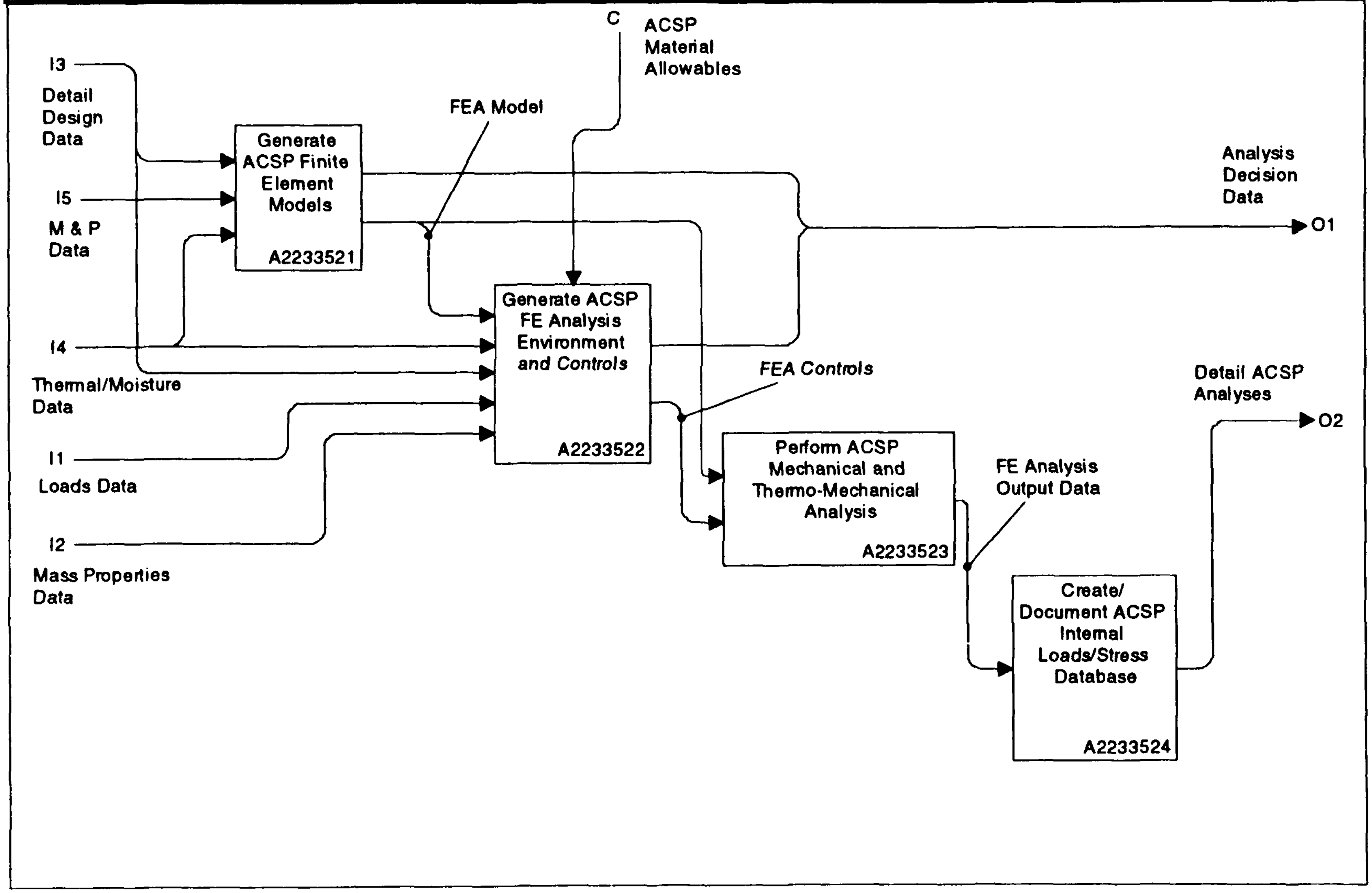
	NODE: A223352	TITLE: Conduct ACSP Finite Element Analysis			



A-223352: Conduct ACSP Finite Element Analysis (FEA)

Activities:

A2233521 **Generate ACSP Finite Element Models**
Generate a discrete geometric approximation of the structural part. Generate and assign elemental connectivity, geometric and material attributes. Set boundary conditions and generate and assign the loading environment. Generate the directives necessary to control the analyses and resulting output.

A2233522 **Generate ACSP Finite Element Analysis Environment and Controls**
Generate, set, and assign Analysis environment data such as boundary constraints, loads, factors of safety, and set up the control of analysis output and the analysis procedure itself.

A2233523 **Perform ACSP Mechanical/Thermo-mechanical Finite Element Analysis**
Perform linear or nonlinear mechanical/thermo-mechanical analyses of the structural part by submitting the completed finite element model for analysis by the appropriate finite element analysis application.

A2233524 **Create/Document ACSP Internal Loads/Stress Database**
Create and document an internal loads and stress database by inputting data from an existing solution or a PDES/STEP Exchange File, and then documenting it with textual and graphical post-processing applications.

Inputs:

I1 **Loads Data**
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I2 **Mass Properties Data**
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

I3 **Detail Design Data**
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4 **Thermal/Moisture Data**
The thermal and moisture environment of the ACSP.

I5 **M & P Data**
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 **ACSP Material Allowables**
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 **Analysis Decision Data**
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

Mechanisms:

(None)

Process Interactions:

- **FE Analysis Output Data**
  The deflection, stress, strain, interlaminar shear, reaction and internal load, and various output matrices that result from a finite element analysis.
- **FEA Controls**
  The boundary constraints and releases, load sets and combinations, allowables, output requests and analysis procedure controls that are combined with a finite element model to provide input to a finite element analysis.
- **FEA Model**
  The nodes, elements, element properties, material properties and associated administrative data that are combined with the FEA controls to form input to a finite element analysis.

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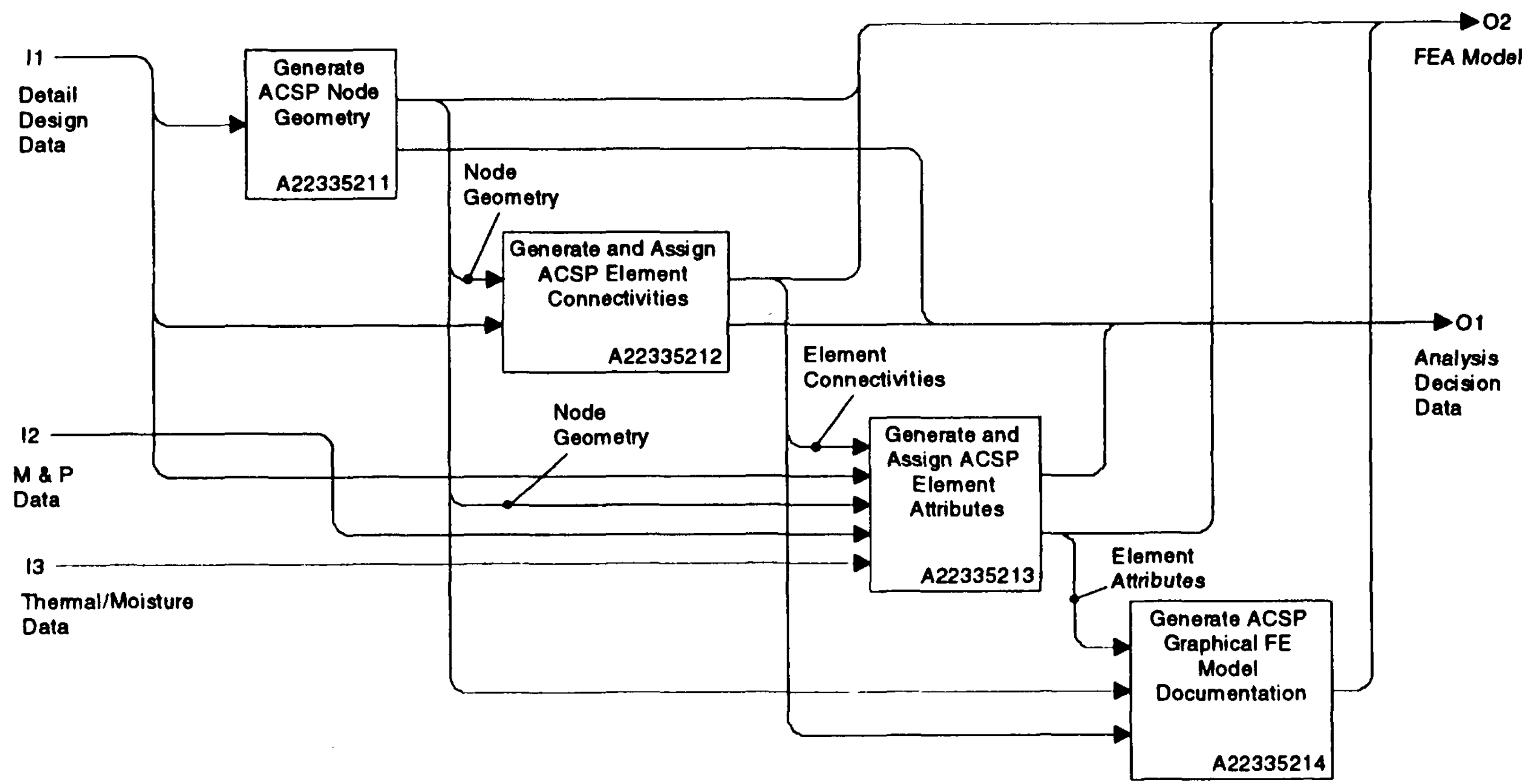
	NODE: A2233521	TITLE: Generate ACSP Finite Element Models					



124

A-2233521: Generate ACSP Finite Element Models

Activities:

A22335211 Generate ACSP Node Geometry
Discretize the surface or volume of the structural part by creating point geometry identical or related to the structural part geometry. Placement of the nodes on or within the structural part is governed by the fineness of the mesh needed to adequately discretize the deflection and strain fields of the structural part under the applied loading environment.

A22335212 Generate and Assign ACSP Element Connectivities
Connect element to corner, mid-edge, mid-face and mid-volume nodes to approximate the continuum of the structural part.

A22335213 Generate and Assign ACSP Element Attributes
Generate and assign element geometrical, material and ply related attributes.

A22335214 Generate ACSP Graphical Finite Element Model Documentation
Generate the graphical documentation of the nodes and elements, and their associated attributes.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

I3 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 FEA Model
The nodes, elements, element properties, material properties and associated administrative data that are combined with the FEA controls to form input to a finite element analysis.

Mechanisms:

(None)

Process Interactions:

- Element Attributes
  The geometric and material attributes necessary to describe the various finite element continuum idealizations. For example the curve elements require cross section, offset, and material data; the surface elements thickness, offset and material data; and the volume elements only material data for their respective attributes.
- Element Connectivities
  The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.
- Node Geometry
  The geometric position data for the node, and any necessary identifiers.

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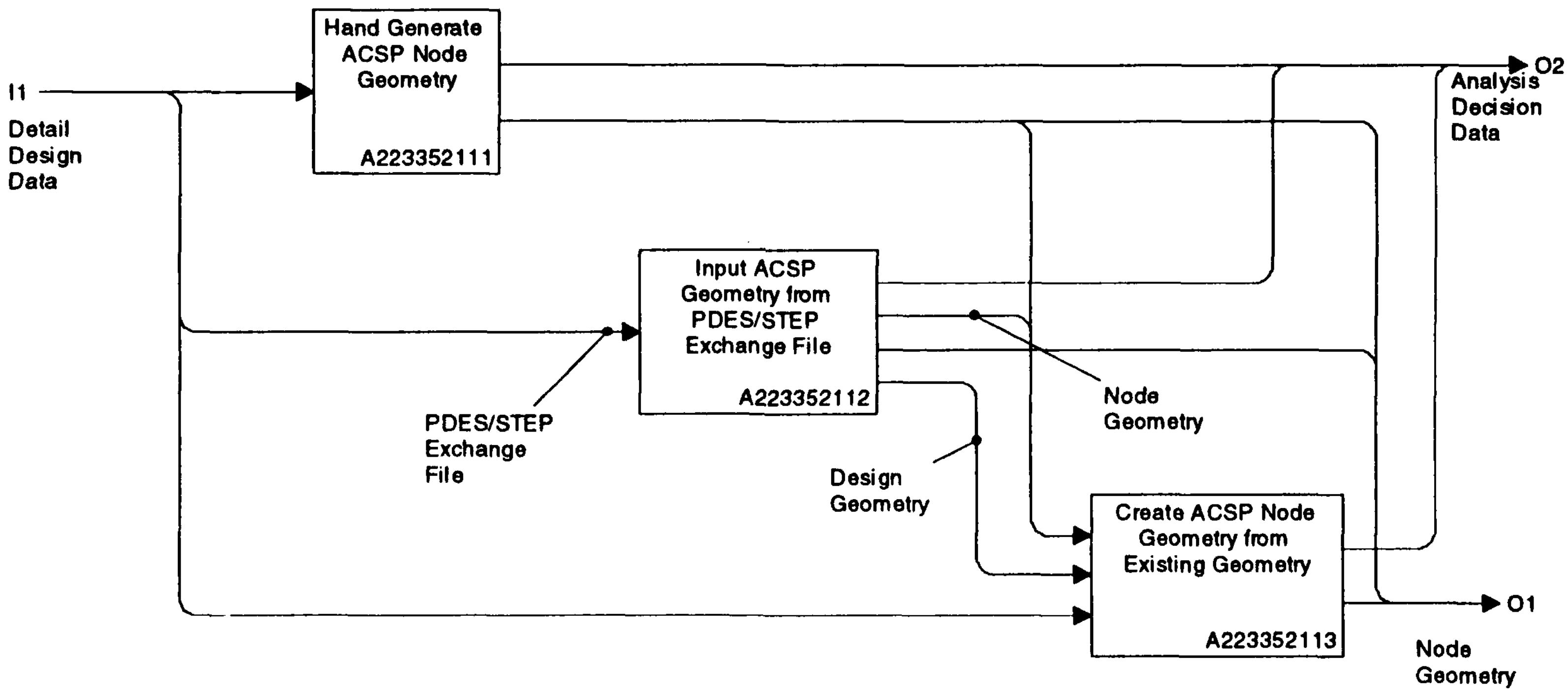
	NODE: A22335211	TITLE: Generate ACSP Node Geometry			



12b

A-22335211: Generate ACSP Node Geometry

Activities:

A223352111 Hand Generate ACSP Node Geometry
Generate node geometry by measuring parts, scaling drawings, or freehand, and hand input the nodal coordinate data into a computer disk file.

A223352112 Input ACSP Geometry from PDES/STEP Exchange File
Import geometry from a PDES/STEP file into a Finite Element mesh creation and editing program. Nodal geometry is then created from the computer representation of the structural part. Computerized applications may be used to automate node generation.

A223352113 Create ACSP Node Geometry from Existing Geometry
Nodal geometry is created from the existing computer representation of the structural part. Computerized applications may be used to automate node generation.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

- PDES/STEP Exchange File
  A Level 1 Physical File format that conforms to the PDES/STEP international standard.

Controls:

(None)

Outputs:

O1 Node Geometry
The geometric position data for the node, and any necessary identifiers.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

Mechanisms:

(None)

Process Interactions:

- Design Geometry
  The three-dimensional point, curve, surface and volume information that describes the geometric representation of the ACSP.
- Node Geometry
  The geometric position data for the node, and any necessary identifiers.

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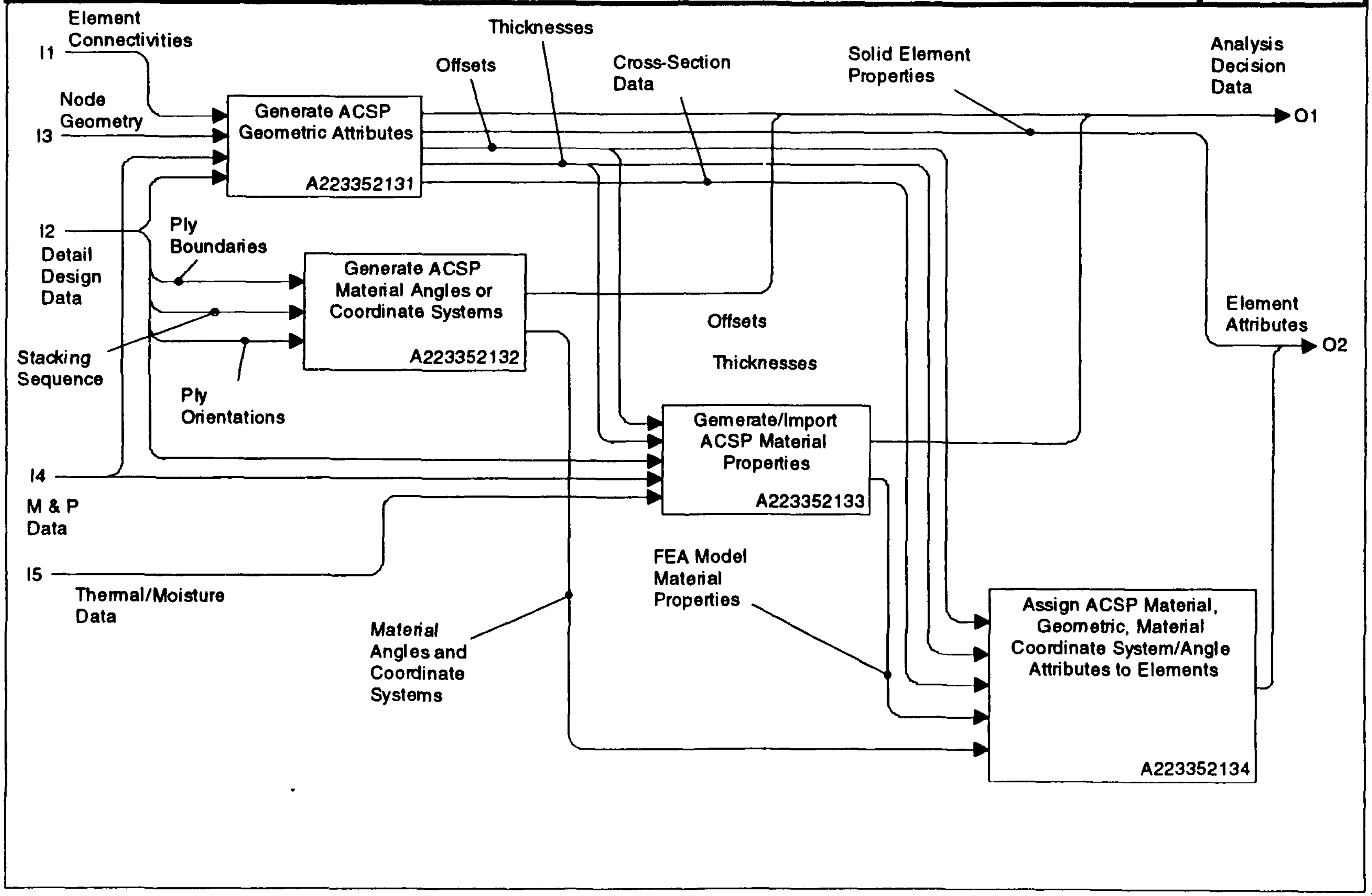
	NODE: A22335213	TITLE: Generate and Assign ACSP Element Attributes			



A-22335213: Generate and Assign ACSP Element Attributes

Activities:

A223352131 Generate ACSP Geometric Attributes
Generate element geometric attributes such as thicknesses for surface elements, and areas and cross-section dimensions for curve elements.

A223352132 Generate ACSP Material Orientation Angles or Coordinate Systems
Generate material orientation angles by relating elements to coordinate systems, or by individual calculations. Alternatively a material direction may be assigned to a coordinate system reference.

A223352133 Generate/Import ACSP Material Properties
Either generate, import or retrieve from a database of material properties.

A223352134 Assign ACSP Material, Geometric, Material Coordinate System/Angle Attributes to Elements
Assign the material, geometric, material coordinate system/angle attributes as appropriate to elements.

Inputs:

I1 Element Connectivities
The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.

I2 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

- Ply Boundary
  The location of the outer contiguous boundary of a ply.
- Ply Orientations
  The orientations of the plies in an ACSP.
- Stacking Sequence
  The orientations of the plies in an ACSP in order that the plies are laid down on the manufacturing tool.

I3 Node Geometry
The geometric position data for the node, and any necessary identifiers.

I4 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

I5 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 *Analysis Decision Data*
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 Element Attributes
The geometric and material attributes necessary to describe the various finite element continuum idealizations. For example the curve elements require cross section, offset, and material data; the surface elements thickness, offset and material data; and the volume elements only material data for their respective attributes.

Mechanisms:

(None)

Process Interactions:

- Cross-section Data
  Data describing the extensional and beam bending behavior of a TCA.
- FEA Model Material Properties
  The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

- Material Angles and Coordinate Systems
  Either the angle that the material 11 direction makes with the element coordinate system, or a reference directly to a coordinate system that defines the material 11, 22 and 33 directions.

- Offsets
  Any *offsets* needed to *describe* the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

- Solid Element Properties
  The properties necessary to describe the structural response of a volume element.

- Thermal/Moisture Data
  The thermal and moisture environment of the ACSP.

- Thicknesses
  The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

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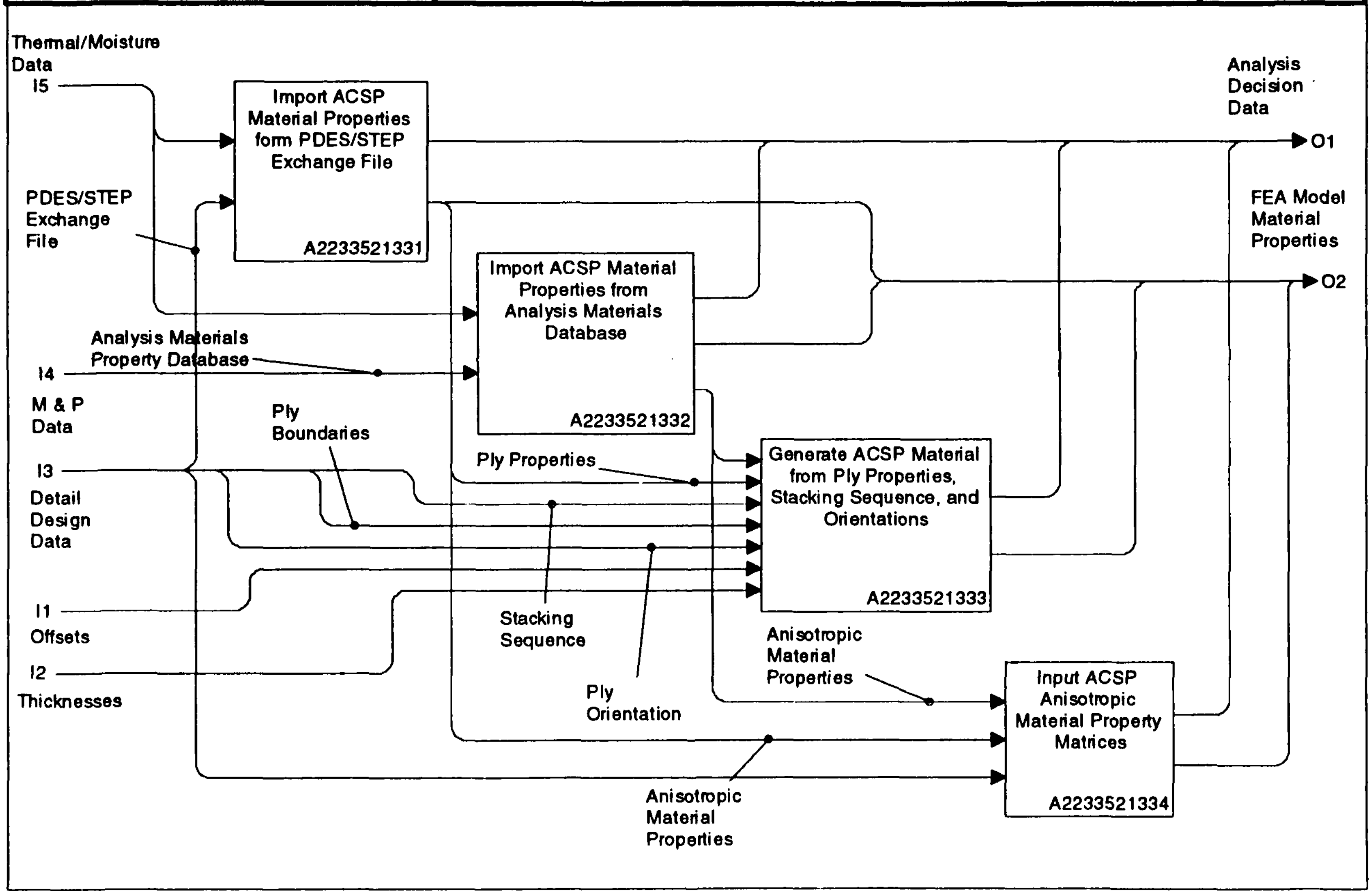
	NODE: A223352133	TITLE: Generate/Import ACSP Material Properties			



132

A-223352133: Generate/Import ACSP Material Properties

Activities:

A2233521331 Import ACSP Material Properties from PDES/STEP Exchange File

Import material properties from a PDES/STEP Exchange File, and retrieve the necessary data.

A2233521332 Import ACSP Material Properties from Analysis Materials Database

Import material properties from an analysis materials database, and retrieve the necessary data.

A2233531333 Generate ACSP Material Properties from Ply Properties, Stacking Sequence and Orientations

Generate material properties from ply properties, stacking sequence and orientations.

A2233521334 Input ACSP Anisotropic Material Property Matrices

Input material property matrices data.

Inputs:

I1 Offsets

Any offsets needed to describe the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

I2 Thicknesses

The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

I3 Detail Design Data

The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

- PDES/STEP Exchange File
  A Level 1 Physical File format that conforms to the PDES/STEP international standard.

- Ply Orientations
  The orientations of the plies in an ACSP.

- Ply Properties
  The material properties of the ply.

- Stacking Sequence
  The orientations of the plies in an ACSP in order that the plies are laid down on the manufacturing tool.

I4 M & P Data

All of the data needed to describe the physical responses of a composite material or its plies.

- Analysis Materials Property Database
  A database of all M & P data required to perform composite structural analyses.

I5 Thermal/Moisture Data

The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data

The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 FEA Model Material Properties

The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

Mechanisms:

(None)

Process Interactions:

- Anisotropic Material Properties
  The two or three dimensionally anisotropic elastic and thermal expansion matrices that describe the response of a composite material.

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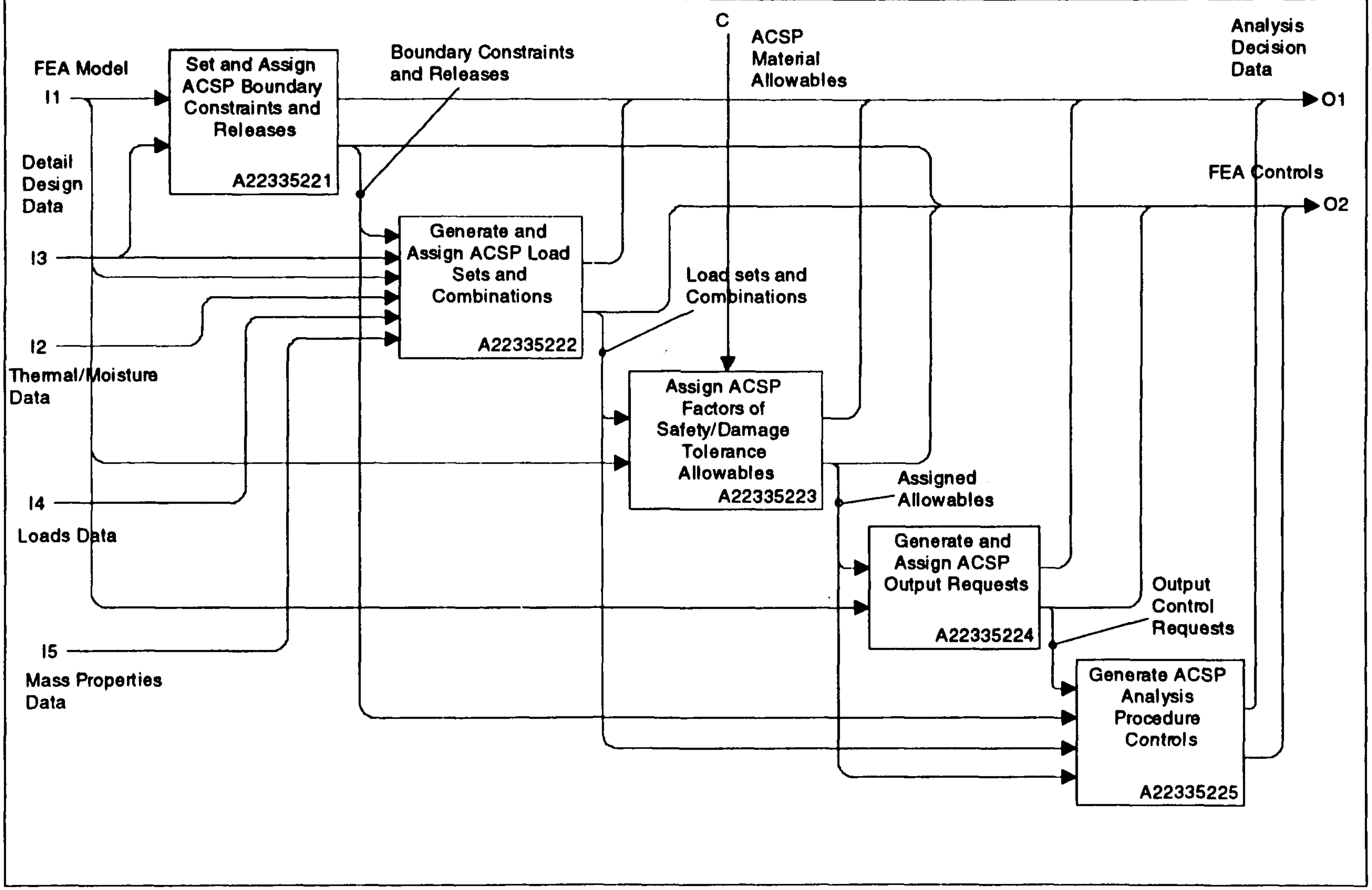
	NODE: A2233522	TITLE: Generate ACSP FE Analysis Environment and Contro			



134

A-2233522: Generate ACSP F E Analysis Environment and Controls

Activities:

A22335221 Set and Assign ACSP Boundary Constraints and Releases
Set and assign boundary constraints and releases that approximate the support and/or symmetry boundary conditions for the analysis of the structural part.

A22335222 Generate and assign ACSP Load Sets and Combinations.
Generate and assign nodal and elemental loadings that approximate the forces, temperatures and/or displacements acting on the structural part, and request the combination of load sets to approximate complicated loading conditions from simpler loading components.

A22335223 Assign ACSP Factors of Safety, Durability/Damage Tolerance Allowables
Assign acceptable factors of safety, durability and damage tolerance allowables for elements.

A22335224 Generate and Assign ACSP Analysis Output Control Requests
Generate and assign output control requests for each of the types of data required to be output.

A22335225 Generate ACSP Analysis Procedure Controls
Generate the necessary directives to control the analysis process in the intended analysis code.

Inputs:

I1 FEA Model
The nodes, elements, element properties, material properties and associated administrative data that are combined with the FEA controls to form input to a finite element analysis.

I2 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I3 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I5 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established *by a material test program and further influenced by durability and damage tolerance* requirements.

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 FEA Controls
The boundary constraints and releases, load *sets and combinations*, allowables, output requests and analysis procedure controls that are combined with a finite element model to provide input to a finite element analysis.

Mechanisms:

(None)

Process Interactions:

- Assigned Allowables
  The factor of safety and durability/damage tolerance allowables that have been assigned to an element.

- Boundary Constraints and Releases
  The constraints and releases applied to the nodes of the finite element model to simulate the presence of connecting structure and/or mountings/attachments.

- Load Sets and Combinations
  A load set or combination of load sets provides a complete set of loads data. There may be one or more load sets or combinations of load sets in a given finite element analysis.

- Output Control Requests
  Requests for the finite element analysis code to selectively output the various types of analysis output data.

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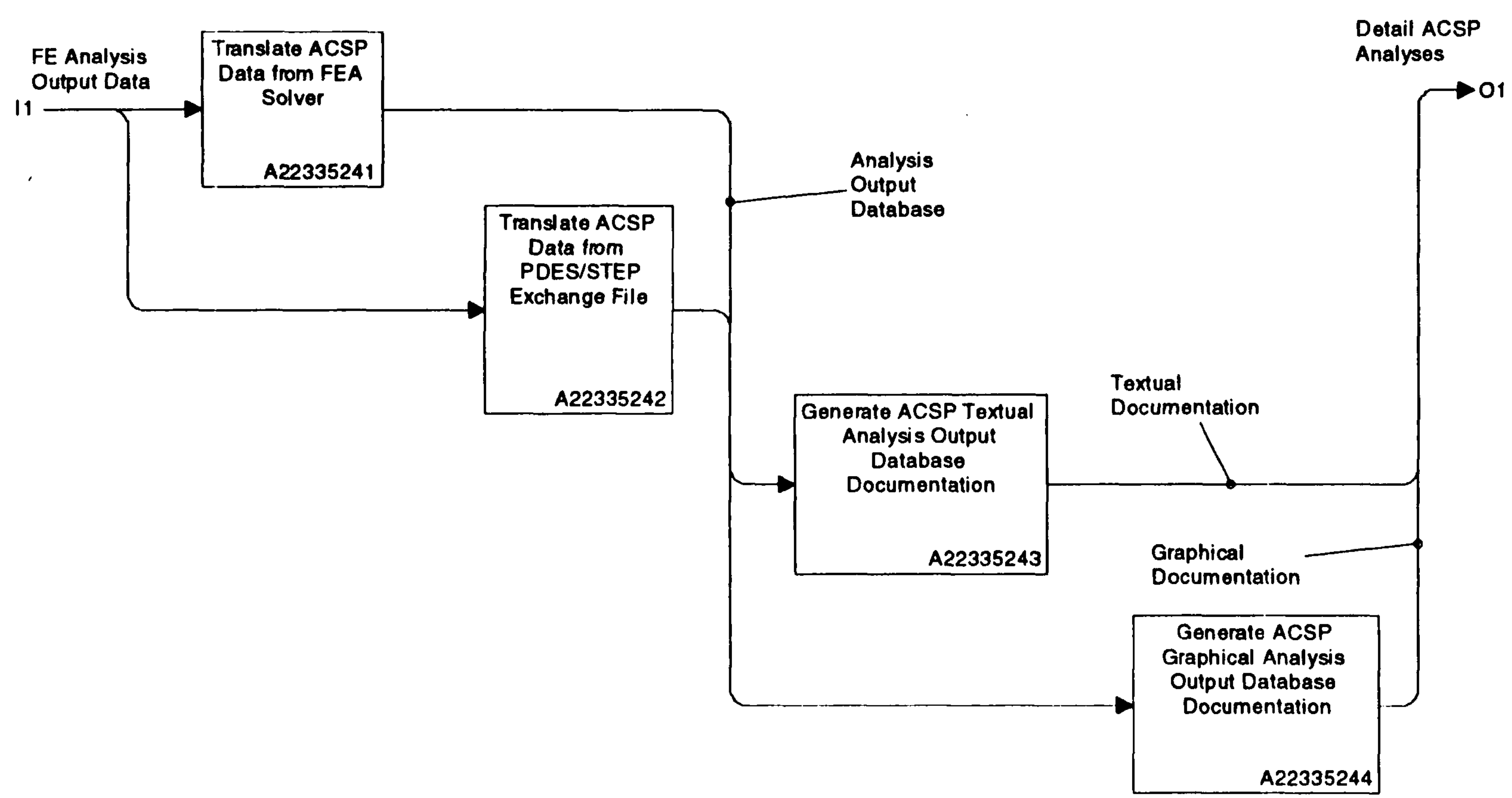
	NODE: A2233524	TITLE: Create/ Document ACSP Internal Loads/Stress Data			



A-2233524: Create/Document ACSP Internal Loads/Stress Data

Activities:

A22335241 Translate ACSP Data from FEA Solver
Translate analysis output data from an existing solution into an internal loads/stress database application.

A22335242 Translate ACSP Data from PDES/STEP Exchange File
Translate analysis output data from a PDES/STEP Exchange File into an internal loads/stress database application.

A22335243 Generate ACSP Textual Analysis Output Database Documentation
Generate textual documentation of the internal loads/stress database such as min/max margin of safety distributions for skin elements, or a force freebody of a stiffener.

A22335244 Generate ACSP Graphical Analysis Output Database Documentation
Generate graphical documentation of the internal loads/stress database such as color fringe plots of strain distributions over a skin.

Inputs:

I1 FE Analysis Output Data
The deflection, stress, strain, interlaminar shear, reaction and internal load, and various output matrices that result from a finite element analysis.

Controls:

(None)

Outputs:

O1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- Graphical Documentation
  Graphical documentation of the analysis output data from a finite element analysis.
- Textual Documentation
  Graphical documentation of the analysis output data from a finite element analysis.

Mechanisms:

(None)

Process Interactions:

- Analysis Output Database
  A database of FE Analysis Output Data.

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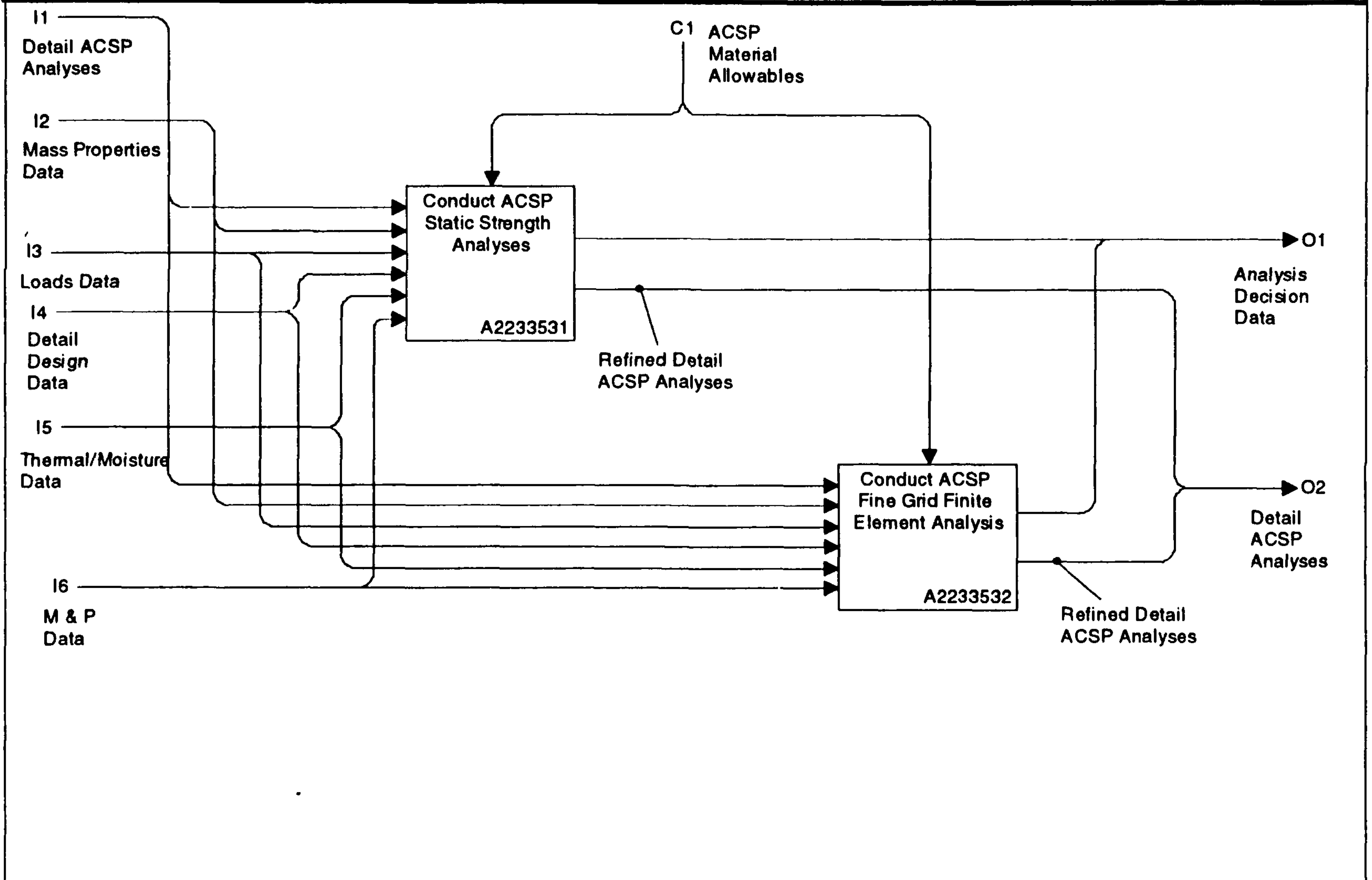
	NODE: A223353	TITLE: Conduct ACSP Detail Stress Analysis					



A-223353: Conduct ACSP Detail Stress Analysis

Activities:

A2233531 Conduct ACSP Static Strength Analyses
Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A2233532 Conduct ACSP Fine Grid Finite Element Analysis
Conduct fine grid finite element analyses of details of the structural part that were not appropriate to include in the overall structural part (coarse grid) finite element analysis.

Inputs:

I1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I2 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

I3 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I4 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I5 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I6 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

Mechanisms:

(None)

Process Interactions:

(None)

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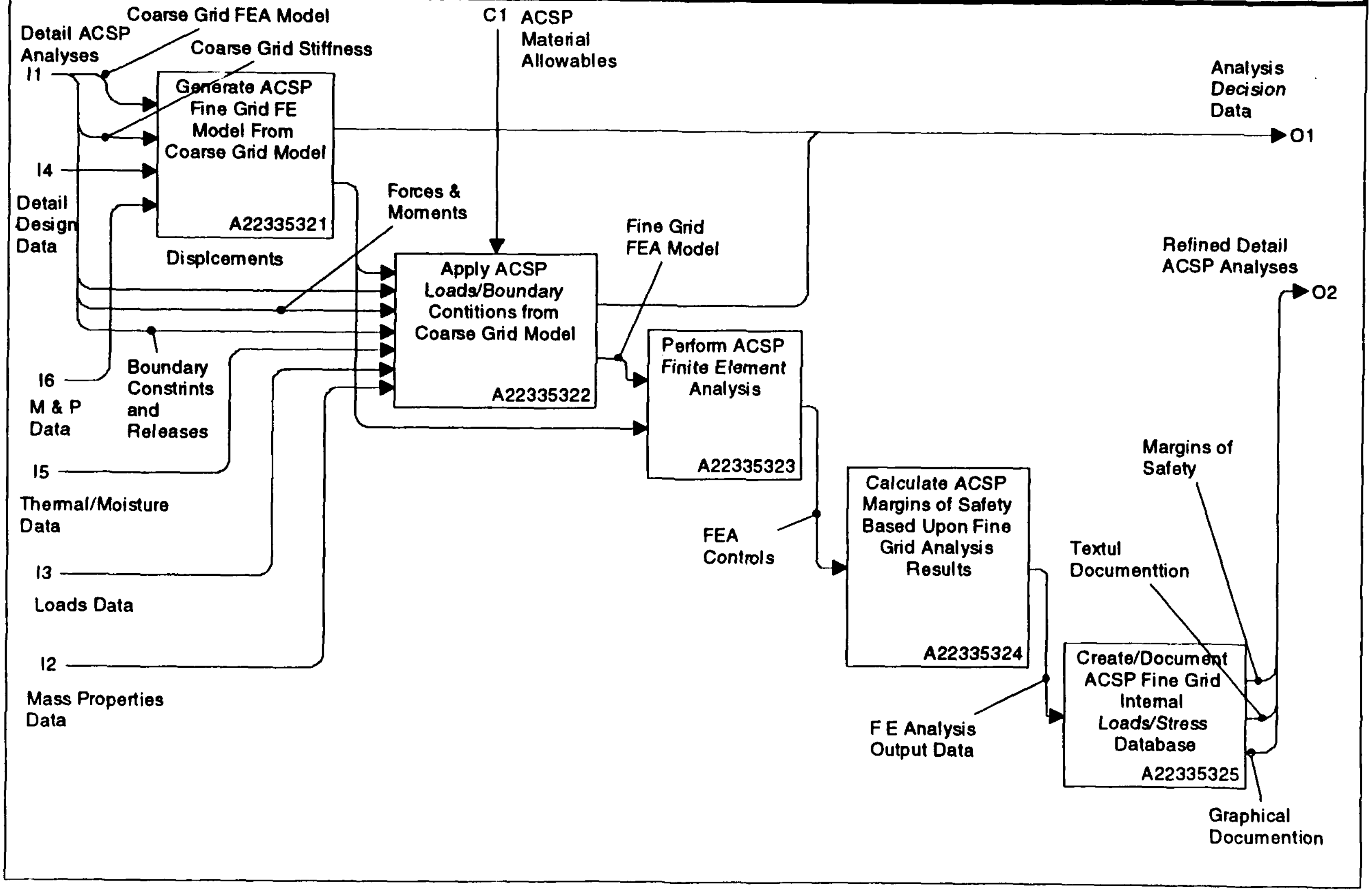
			I	DRAFT		PUBLICATION	
	NODE: A2233532	TITLE: Conduct ACSP Fine Grid Finite Element Analysis					



142

A-2233532: Conduct ACSP Fine Grid Finite Element Analysis

Activities:

A22335321 Generate ACSP Fine Grid Finite Element Model from Coarse Grid Model
Use the existing structural part finite element model to provide a geometric basis for generating a finer grid mesh to provide more deflection and strain resolution for a detailed finite element analysis.

A22335322 Apply ACSP Loads/Boundary Conditions from Coarse Grid Model
Use data from the internal loads/stress database to provide applied loads and displacements for the fine grid analysis.

A22335323 Perform ACSP Finite Element Analysis
Perform finite element analyses as in A2233523.

A22335324 Calculate ACSP Margins of Safety Based upon Fine Grid *Analysis Results*
Use data from overall structural part and fine grid finite element analyses to assign margins of safety for structural details of the structural part.

A22335325 Create/Document ACSP Fine Grid Internal Loads/Stress Database Results
Create an internal loads and stress database by inputting data from the fine grid analysis.

Inputs:

I1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- Coarse Grid FEA Model
  The finite element model used for the overall ACSP static stress analysis.

- Coarse Grid Stiffness
  The stiffness matrix (substructure or superelement) that represents the stiffness of the coarse grid model at attachment points to the fine grid model to supply proper flexible boundary conditions.

- Boundary Constraints and Releases
  The constraints and releases applied to the nodes of the finite element model to simulate the presence of connecting structure and/or mountings/attachments.

- Forces and Moments
  The applied and resulting forces and moments at each of the nodes of the finite element model that are produced by the finite element analysis.

- Displacements
  The displacements of the nodes of the finite element model that result from a finite element analysis.

I2 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

I3 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I4 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I5 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I6 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 **Analysis Decision Data**
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 **Refined Detail ACSP Analyses**
output data from fine grid finite element analyses, and the ...tion of the decisions taken during those analyses.

Mechanisms:

(None)

Process Interactions:

- FE Analysis Output Data
  The deflection, stress, strain, interlaminar shear, reaction and internal load, and various output matrices that result from a finite element analysis.

- FEA Controls
  The boundary constraints and releases, load sets and combinations, allowables, output requests and analysis procedure controls that are combined with a finite element model to provide input to a finite element analysis.

- Fine Grid FEA Model
  A finite element model that is based upon a coarse grid model that provides additional mesh refinement in a particular area of interest. The finer mesh provides greater analysis accuracy (in the fine grid area) than is otherwise feasible with a large scale coarse grid finite element model.

- Graphical Documentation
  Graphical documentation of the analysis output data from a finite e[illegible]nent analysis.

- Margins of Safety
  A ratio of actual to allowable stress or strain. A ratio greater than one means that the value of stress or strain will meet the design criteria.

- Textual Documentation
  Graphical documentation of the analysis output data from a finite element analysis.

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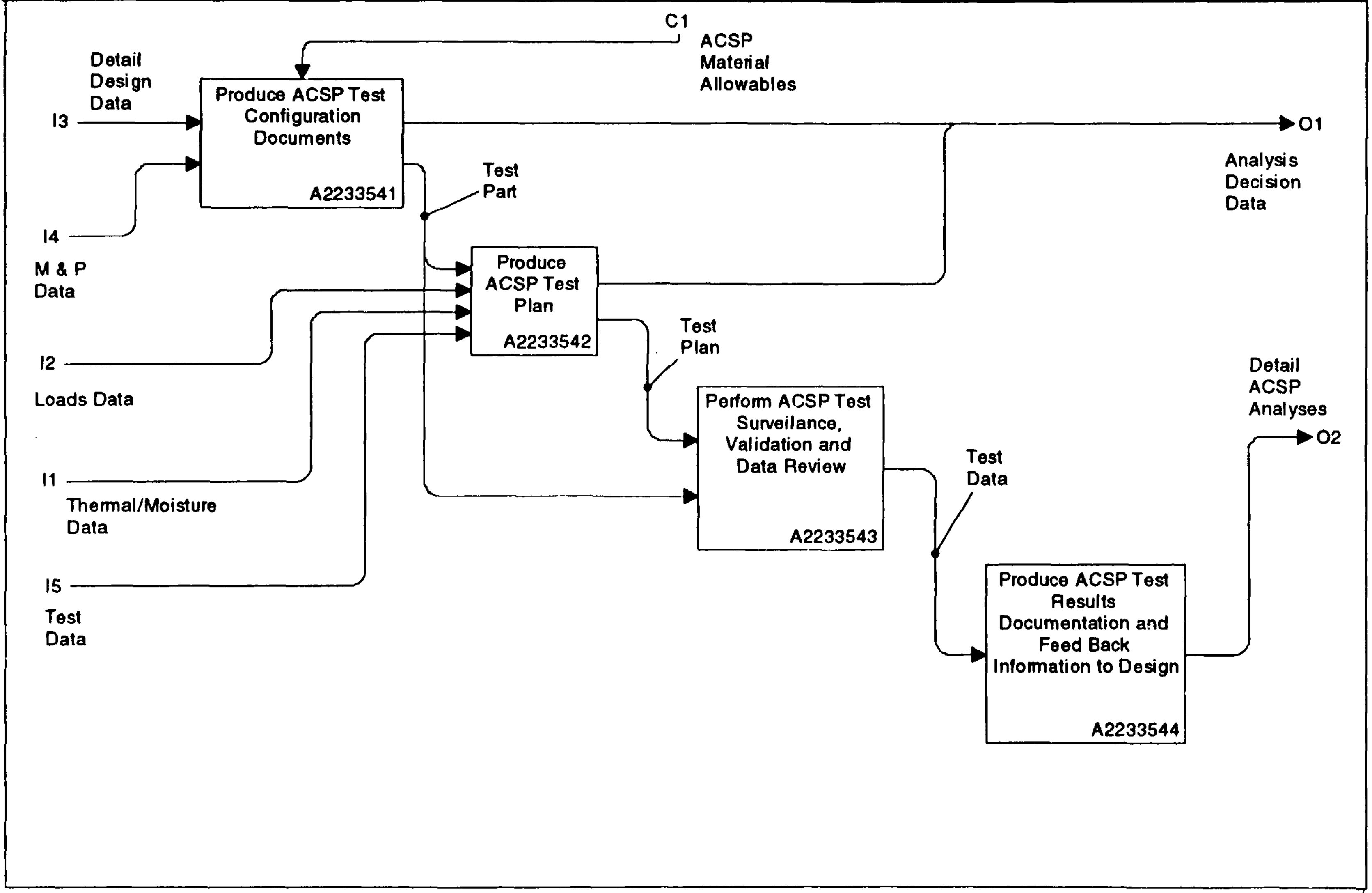
	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION
	NODE: A223354	TITLE: Plan ACSP Tests and Analyze Results				CONTEXT:



146

A-223354: Plan ACSP Tests and Analyze Test Results

Activities:

A2233541 Produce ACSP Test Part Configuration Documents
Produce documents to define the configuration of the part and supporting test fixtures.

A2233542 Produce ACSP Test Plan
Produce documents defining the testing of the structural part.

A2233543 Perform ACSP Test Surveillance, Validation and Data Review
Monitor the structural tests, validate the output, and review and document results.

A2233544 Produce ACSP Test Results Documentation and Feed Back Information to Design
Document the results of ACSP testing and feed back the resulting assessments to design.

Inputs:

I1 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I2 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I3 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

I5 Test Data
Data resulting from structural tests of an ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

Mechanisms:

(None)

Process Interactions:

- Test Data
  Data resulting from structural tests of an ACSP.
- Test Part
  The element or sub-component of the ACSP that is being tested.
- Test Plan
  A plan developed to describe the testing process of the test part.

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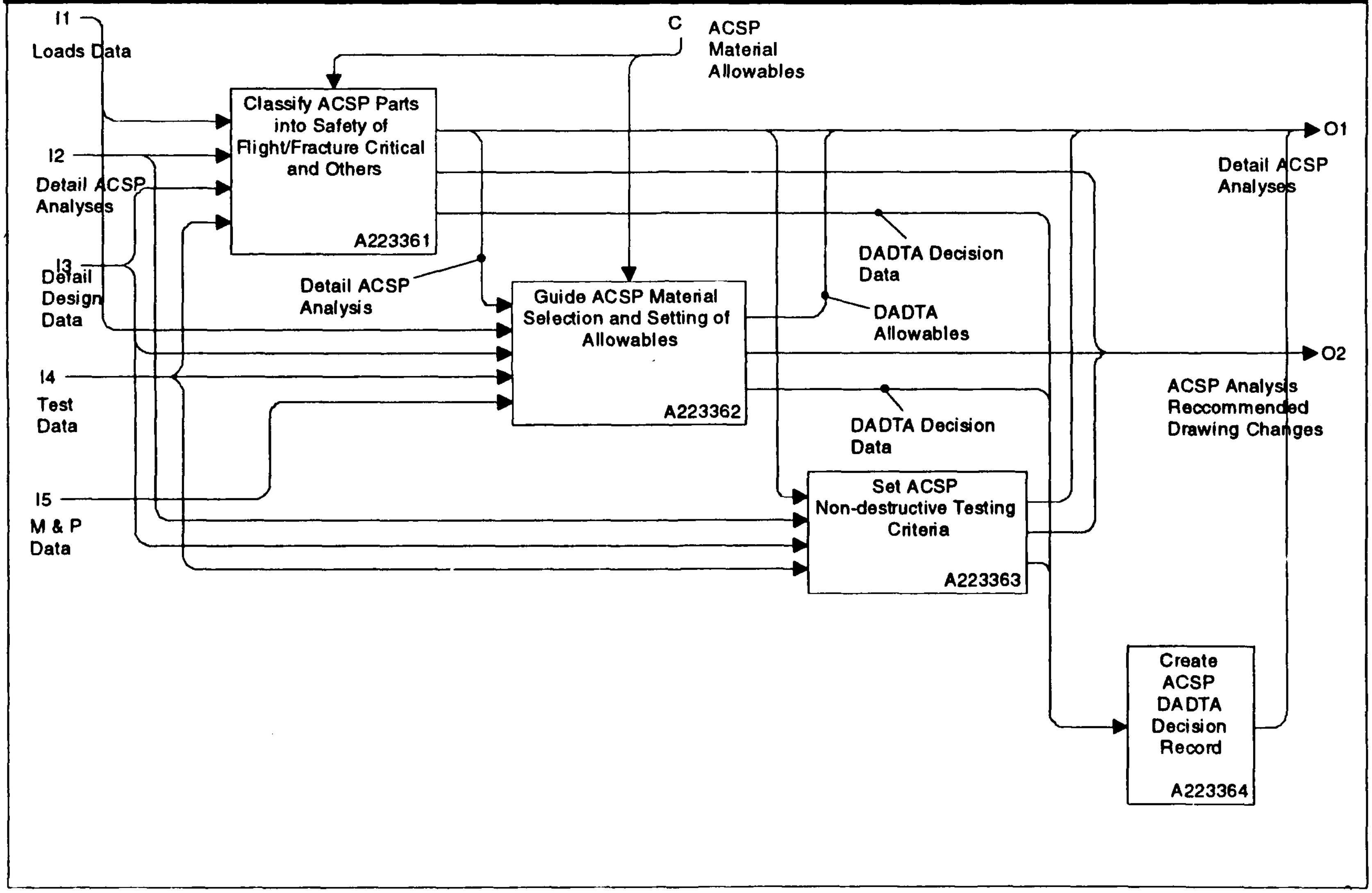
			X	DRAFT		PUBLICATION	
	NODE: A22336	TITLE: Conduct ACSP Durability and Damage Tolerance Ana					



148

A-22336: Conduct ACSP Durability and Damage Tolerance Analysis

Activities:

A223361 **Classify ACSP Parts into Safety of Flight/Fracture Critical and Others**
Classify structural parts as safety of flight critical or otherwise based upon damage and environmental threats.

A223362 **Guide ACSP Material Selection and Setting of Material Allowables**
Guide selection of materials that are durable and damage tolerant, and set material allowables based upon analytical and experimental criteria.

A223363 **Set ACSP Non-Destructive Inspection Allowables**
Set non-destructive inspection allowables based upon delamination and void content criteria.

A223364 **Create ACSP Durability and Damage Tolerance Analysis Decision Record**
Create a record of the decisions made during the durability and damage analyses and assessments.

Inputs:

I1 **Loads Data**
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I2 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I3 **Detail Design Data**
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4 **Test Data**
Data resulting from structural tests of an ACSP.

I5 **M & P Data**
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 **ACSP Material Allowables**
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- **DADTA Allowables**
  The material mechanical and thermal allowables that take into account DADTA analyses and criteria.
- **DADTA Decision Data**
  The data that records the decisions and idealizations made during the DADTA analysis of the ACSP.

O2 **ACSP Analysis Recommended Drawing Changes**
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

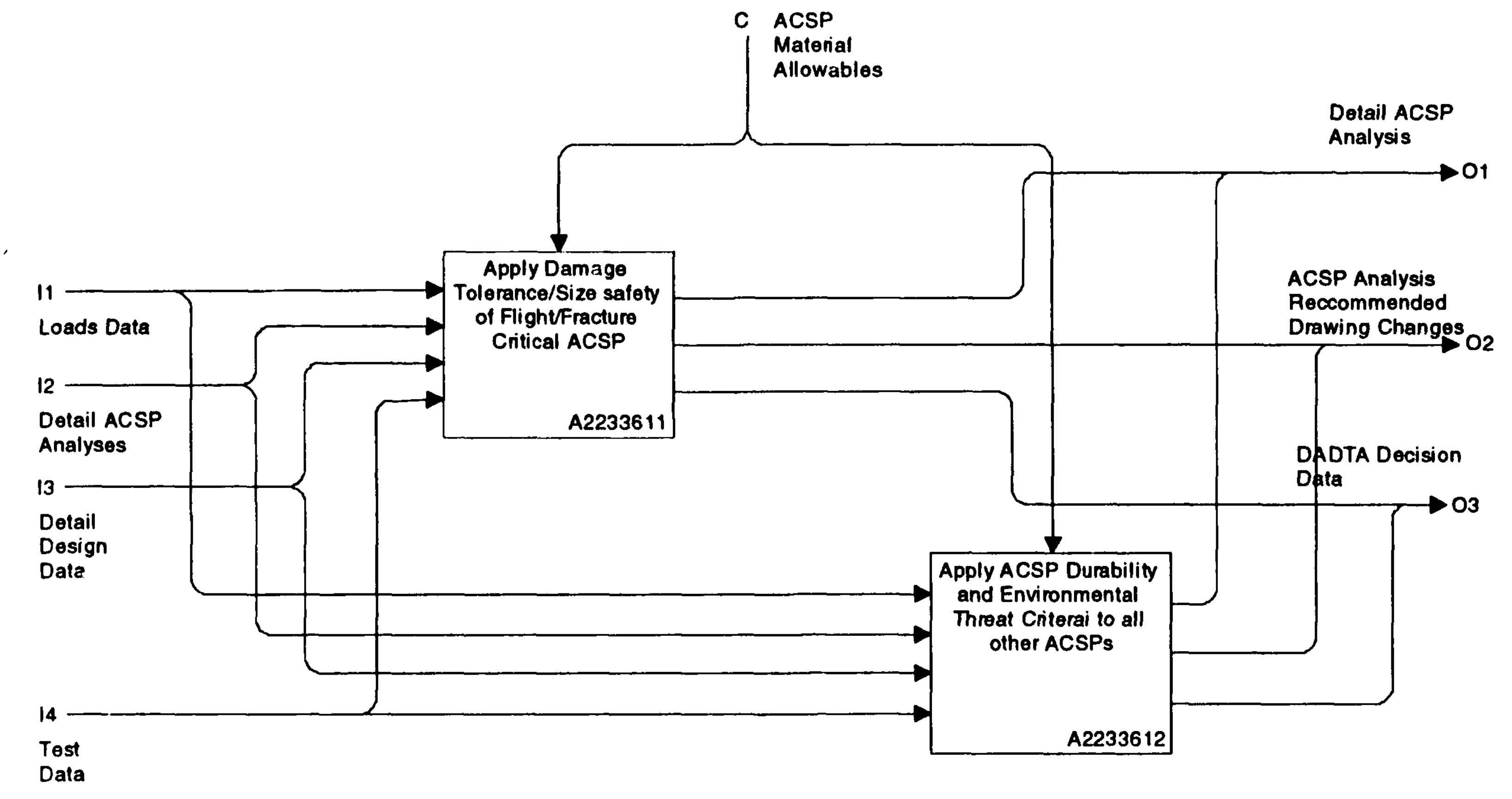
Mechanisms:

(None)

Process Interactions:

- **DADTA Decision Data**
  The data that records the decisions and idealizations made during the DADTA analysis of the ACSP.
- **Detail ACSP Analyses**
  All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
LTV, GD & Boeing			X	DRAFT		PUBLICATION	
	NODE: A223361	TITLE: Classify ACSP Parts into Safety of Flight/Fractu					



150

A-223361: Classify Parts into Safety of Flight/Fracture Critical and Others

Activities:

A2233611 Apply ACSP Damage Tolerance Criteria/Size to Safety of Flight/Fracture ACSP
Classify and apply structural parts as safety of flight critical based upon typical damage threats such as scratches, delaminations and impacts.

A2233612 Apply ACSP Durability and Environmental Threat Criteria to all other ACSPs
Classify ACSPs an non-safety of flight/fracture critical, and apply durability criteria and asses the effect of environmental threats to the ACSP.

Inputs:

I1 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I2 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I3 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4 Test Data
Data resulting from structural tests of an ACSP.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

O2 ACSP Analysis Recommended Drawing Changes
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

O3 DADTA Decision Data
The data that records the decisions and idealizations made during the DADTA analysis of the ACSP.

Mechanisms:

(None)

Process Interactions:

(None)

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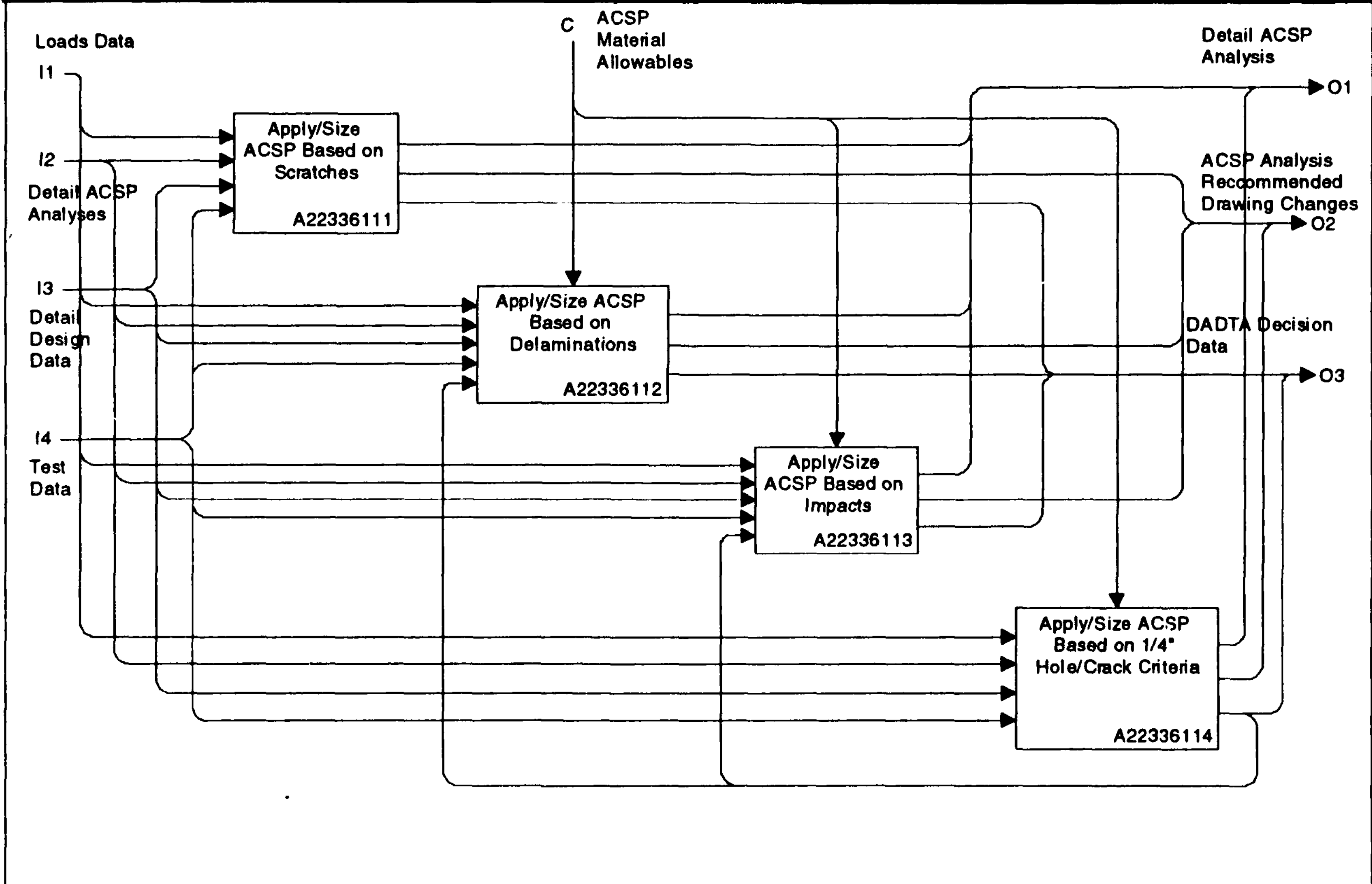
LTV, GD & Boeing	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A2233611	TITLE: Apply Damage Tolerance/Size safety of Flight/Fra					



A-2233611: Apply ACSP Damage Tolerance Criteria/Size to Safety of Flight/Fracture ACSP

Activities:

A22336111 Apply/Size ACSP Based on Scratches
Set criteria for allowable scratches in the surface of structural parts, and size the structural part to resist the threat.

A22336112 Apply/Size ACSP Based on Delaminations
Set criteria for delamination of structural parts, and size the structural part to resist the threat.

A22336113 Apply/Size ACSP Based on Impacts
Set criteria for impacts in the surface of structural parts, and size the structural part to resist the threat.

A22336114 Apply/Size ACSP Based on 1/4" Holes/Crack criteria
Set criteria for 1/4" holes or cracks in structural parts, and size the structural part to resist the threat.

Inputs:

I1 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I2 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I3 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4 Test Data
Data resulting from structural tests of an ACSP.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

Outputs:

O1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

O2 ACSP Analysis Recommended Drawing Changes
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

O3 DADTA Decision Data
The data that records the decisions and idealizations made during the DADTA analysis of the ACSP.

Mechanisms:

(None)

Process Interactions:

(None)

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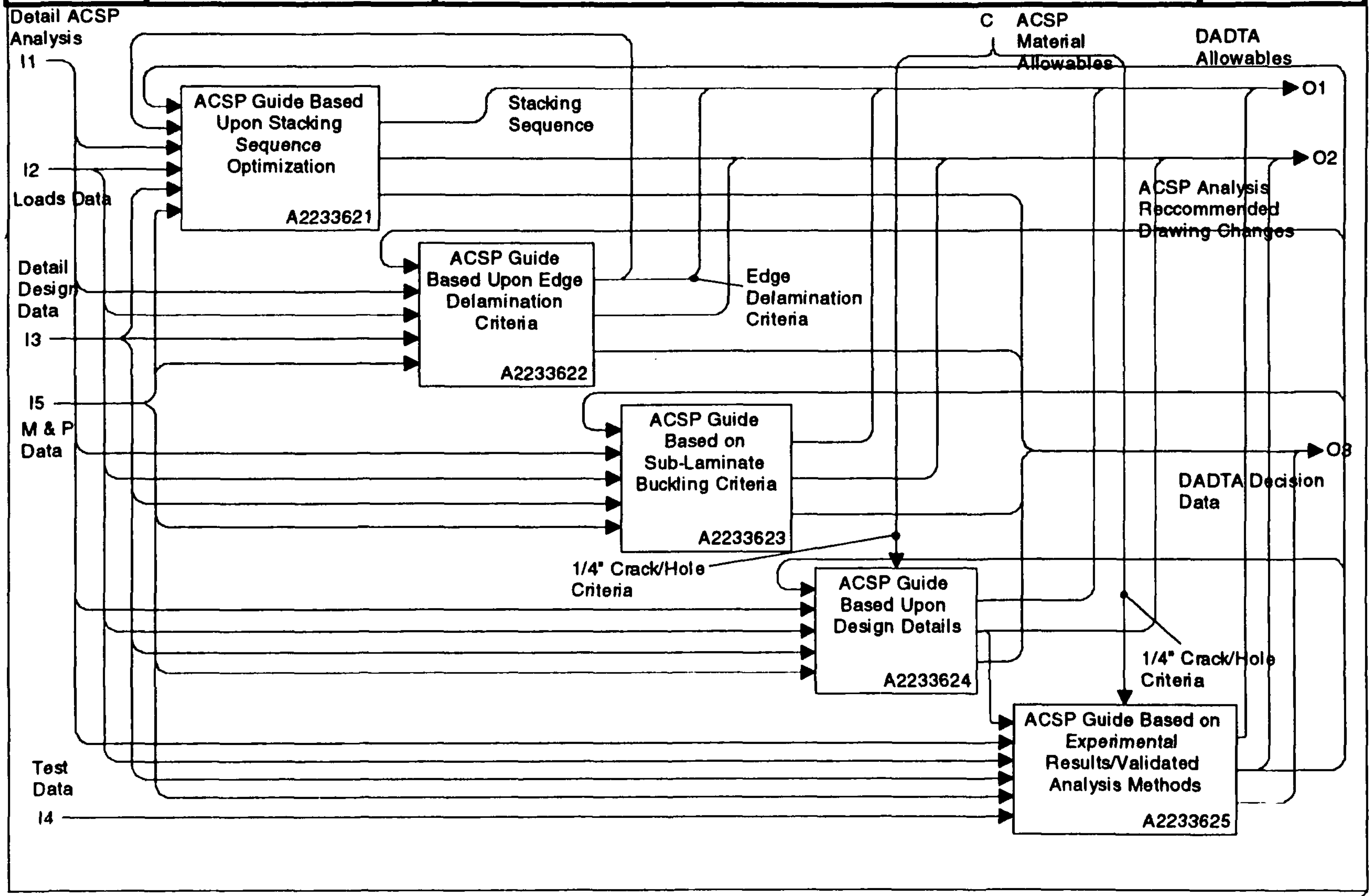
	NODE: A223362	TITLE: Guide ACSP Material Selection and Setting of All			



154

A-223362: Guide ACSP Material Selection and Setting of Allowables

Activities:

A2233621 ACSP Guide based on Stacking Sequence Optimization
Set and optimize material allowables based upon ply stacking sequence.

A2233622 ACSP Guide based on Edge Delamination Criteria
Set and optimize material allowables based upon edge delamination criteria and analyses.

A2233623 ACSP Guide based on Sub-Laminate Buckling Criteria
Set and optimize material allowables based upon sub-laminate buckling criteria and analyses.

A2233624 ACSP Guide based on Design Details
Set and optimize material allowables based upon design detail criteria, 1/4" crack/hole criteria, and analyses.

A2233625 ACSP Guide based on Experimental Results/Validated Analysis Methods
Set and optimize material allowables based upon experimental results and correlated/validated analyses, and 1/4" crack/hole criteria.

Inputs:

I1 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I2. Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I3 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I4. Test Data
Data resulting from structural tests of an ACSP.

I5 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

C1 ACSP Material Allowables
The stress and strain allowables for a composite material. The allowables are established by a material test program and further influenced by durability and damage tolerance requirements.

- 1/4" Crack/Hole Criteria
  The criteria based upon 1/4" crack and hole tests and analyses that is used in turn to set materials allowable criteria.

Outputs:

O1 DADTA Allowables
The material mechanical and thermal allowables that take into account DADTA analyses and criteria.

O2 ACSP Analysis Recommended Drawing Changes
The recommended changes to the ACSP design that evolved as a result of the Detail ACSP Analysis.

O3 DADTA Decision Data
The data that records the decisions and idealizations made during the DADTA analysis of the ACSP.

Mechanisms:

(None)

Process Interactions:

- Edge Delamination Criteria
  Stacking sequence and orientation criteria to minimize laminate edge delamination.
- Stacking Sequence
  The orientations of the plies in an ACSP in order that the plies are laid down on the manufacturing tool.

BUILD & QA AN ACSP

Build Indentured List

- **A23 Build and QA an ACSP**
  - **A231 Develop ACSP Plan**
    - A2311 Assume ACSP Structure & Method of Manufacture
    - A2312 Develop ACSP Production Plan
    - A2313 Develop ACSP Support Activities Plan
    - A2314 Develop/Certify ACSP Mfg. Process/Materials
    - **A2315 Determine Detail Method of Manufacture**
      - A23151 Complete Manufacturing Parts List
      - A23152 Determine Make/Buy Decisions
      - A23153 Determine Precise Form of Su
  - **A232 Develop ACSP Production Plans**
    - **A2321 Develop ACSP Process Plans**
      - A23211 Plan Structures Assembly
      - A23212 Plan Systems Installations
      - A23213 Develop Sheet Metal Planning
      - A23214 Develop Machine Parts Planning
      - A23215 Develop ACSP Bonding/Composite Planning
        - A232151 Conduct Pre-planning Review
        - A232152 Identify New Tool Requirements and Generate Tool Orders
        - A232153 Develop Work Instructions and Build Sequence
          - A2321531 Identify Standard Operations and Sequence
          - A2321532 Generate Custom Operations and Sequence
          - A2321533 Insert Inspections Steps
          - A2321534 Identify and Resolve Issues
        - A232154 Review Planning with Affected Organizations
        - A232155 Audit & Verify Planning
        - A232156 Provide Mod Planning
      - A23216 Plan for Procured Parts
    - A2322 Develop Support Process Plans
    - A2323 Control, Validate, & Release Planning
  - **A233 Provide Tools**
    - **A2331 Design Tools**
      - A23311 Generate Design Criteria
      - A23312 Conduct Conceptual Tool Design
        - A233121 Review Tooling Concept
        - A233122 Define Tool Material
        - A233123 Select Configuration Type
      - A23313 Perform Detail Tool Design
      - A23314 Review and Approve Tool Design
    - **A2332 Develop NC Programs/Tapes**
      - A23321 Provide Production and Tool NC Programs
        - A233211 Obtain Geometry Data

A233212 Define Automated Process Strategy
A233213 Define NC Motion Data
A233214 Generate Documentation
A233215 Post Process NC Program
A23322 Control NC Programs
A23323 Proof NC Programs
A23324 Release NC Programs
A2333 Fabricate/Rework Tools
A2334 Provide Liaison Support
A234 Procure ACSP Manufacturing Materials
A2341 Control Procurement of ACSP Material
A2342 Procure Material
A2343 Receive & Inspect Raw Materials
A23431 Verify/Record Vendor Documentation
A23432 Update & Print Receiving Documentation
A23433 Unload Transport
A23434 Inspect/Verify Material
A23435 Obtain Test Samples
A23436 Place Material into Proper Storage Area
A2344 Manage and Control Material Inventory
A235 Produce Product (ACSP)
A2351 Perform Production Operations
A23511 Obtain Material
A235111 Remove Material From Storage/Freezer
A235112 Thaw Material
A235113 Cut Material To Size & Kit
A235114 Transport Material
A23512 Obtain & Prepare Tools
A235121 Remove Tool From Storage
A235122 Clean Tool
A235123 Apply Release Agent
A235124 Cure Release Agent & Inspect
A23513 Layup & Assemble ACSP
A23514 Bag & Leak Check ACSP
A235141 Obtain Bagging Material & Cut to Fit
A235142 Seal Bag
A235143 Pull Vacuum & Adjust Bag
A235144 Leak Check Bag & Inspect
A2352 Cure & Tear Down ACSP
A23521 Load Part in Cure Equipment
A23522 Connect Vacuum Sensors & Thermocouples
A23523 Cure/Debulk/Bond/Dry per Specification
A23524 Perform Tear Down Operations
A2353 Trim & Drill ACSP

A23531 Position Part in Trim/Drill Fixtures
A23532 Trim/ Drill Part
A235321 Trim Part Periphery
A235322 Trim Stiffeners
A235323 Drill Holes
A235324 Inspect Trim & Drill Operations
A23533 Remove Part From Fixture
A2354 Assure Product Quality
A23541 Perform Non-Destructive Inspections
A235411 Seal Part For Ultrasonic Inspection
A235412 Perform Ultrasonic Inspection Operation
A235413 Perform X-Ray Inspection Operation
A235414 Perform Dimension/Visual Inspection
A23542 Perform Material Evaluation/Certification
A235421 Obtain Material and/or Test Coupons
A235422 Verify Chemical/Thermal Properties
A235423 Verify Physical Properties
A235424 Verify Mechanical properties
A23543 Analyze Defects & Disposition Part or Material
A2355 Deliver Product
A236 Ship Product
A2361 Print & Verify Transportation Documents
A2362 Protect Part for Shipment
A2363 Load Transport

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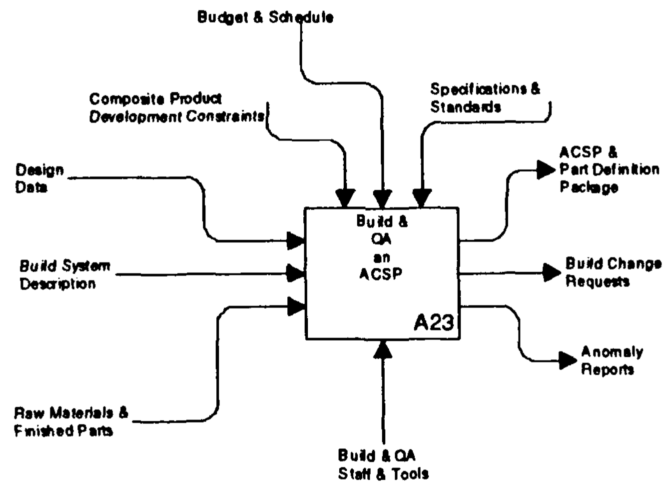
	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A2	TITLE:					



11-2

A2: Manage, Design & Build an ACSP

Activities:

A23 Build & QA an ACSP

The conversion of a design into a finished product and quality assurance *functions that assure that the product meets design requirements. This is* usually a repetitive function, continuing substantially throughout the product's life cycle. It receives the design from Design Functions and outputs the products, spare and repair ACSPs, and technical data on each instance of the product.

Inputs:

I1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

I2 Raw Materials & Finished Parts
All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

I3 Build System Description
The "as-built" *configuration of a product. Includes certification of materials* and processes, part inspection results, rework/repair operations, and verification of all production/inspection steps.

Outputs:

O1 ACSP & Part Definition Package
An ACSP and the accompanying information package that defines the part for the customer.

O2 Build Change Requests
Requests to make modifications to the build data.

O3 Anomaly Reports
All information regarding a part or process that does not fall within accepted limits or may be improved or modified. *This includes, but is not limited to,* incomplete operation reports, discrepancy reports, requests for engineering investigations, request for planning changes, and requests for changes to tooling.

Controls:

C1 Composite Product Development Constraints
Limiting factors on the development of a composite product.

C2 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated with these activities.

C3 Specifications & Standards
Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

Mechanisms:

M1 Build & QA Staff & Tools
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

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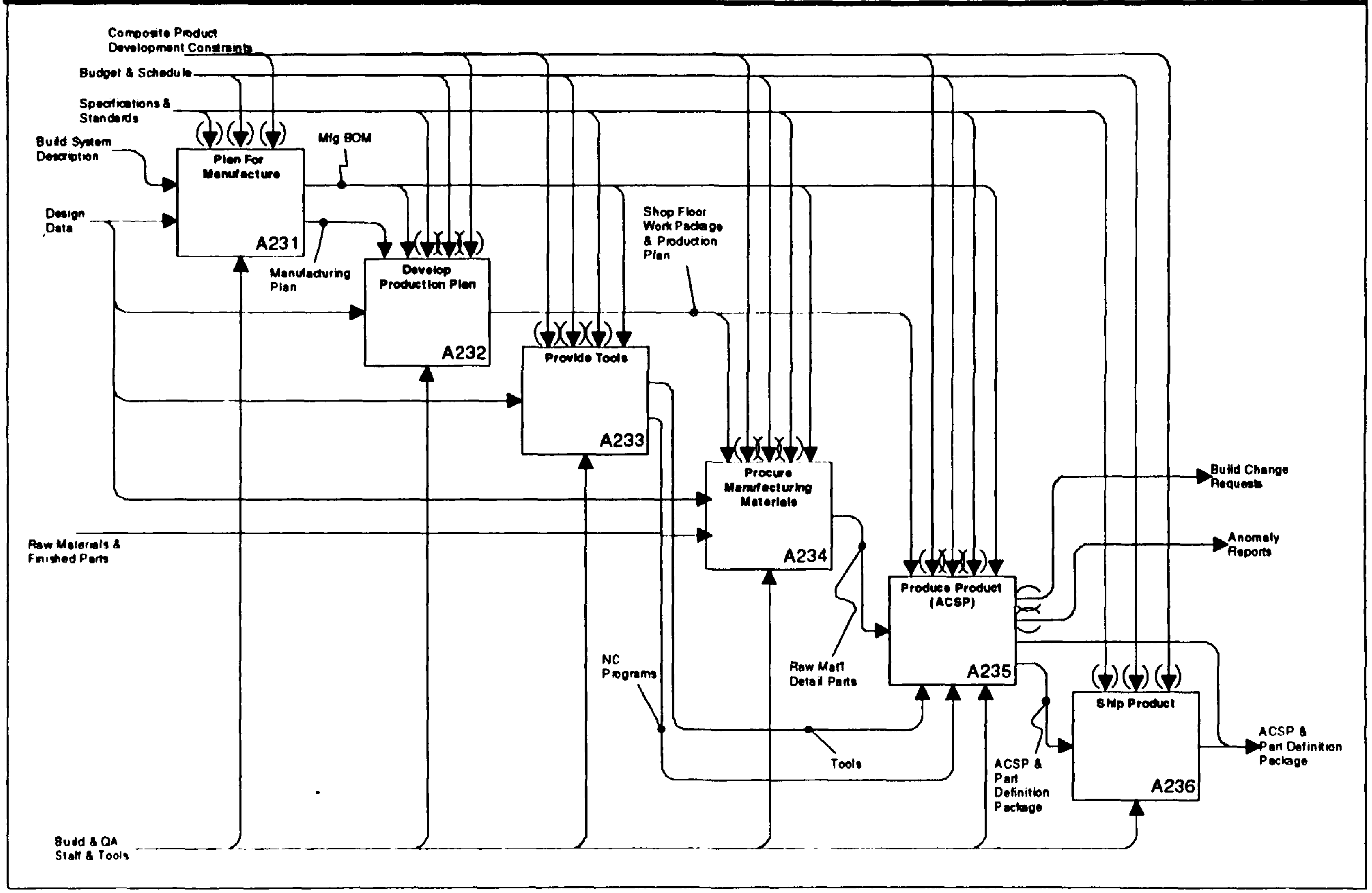
	NODE: A23	TITLE: Build & QA an ACSP		CONTEXT:



A23: Build & QA an ACSP

Activities:

A231 Plan For Manufacture

Translate Engineering product data into manufacturing plans including major assembly breaks, sub-assembly breaks, major tools, facilities, and equipment requirements, as well as make-buy plans.

A232 Develop Production Plan

Translate the overall strategy plans (developed in A1) into specific build activity definition suitable for shop floor workers.

A233 Provide Tools

Perform the tasks required to design, build, and control configuration of tools defined in A1 & A3.

A234 Procure Manufacturing Materials

Obtain all materials required to produce ACSP. This includes receiving, inspection, certification, and storage.

A235 Produce Product (ACSP)

The composite details are produced and assembled into the correct structure. Each step is completed and then inspected to ensure that the ACSPs produced meet the design requirements.

A236 Ship Product

When the part is complete it must be transported to the major assembly operation, or the customer, in a manner that prevents any damage to the part.

Inputs:

I1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

I2 Raw Materials & Finished Parts
All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

I3 Build System Description
The "as-built" configuration of a product. Includes certification of materials and processes, part inspection results, rework/repair operations, and verification of all production/inspection steps.

Outputs:

O1 ACSP & Part Definition Package
An ACSP and the accompanying information package that defines the part for the customer.

O2 Build Change Requests
Requests to make modifications to the build data.

O3 Anomaly Reports
All information regarding a part or process that does not fall within accepted limits or may be improved or modified. This includes, but is not limited to, incomplete operation reports, discrepancy reports, requests for engineering investigations, request for planning changes, and requests for changes to tooling.

Controls:

C1 Composite Product Development Constraints
Limiting factors on the development of a composite product.

C2 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated with these activities.

C3 Specifications & Standards

Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

Mechanisms:

M1 Build & QA Staff & Tools

All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Mfg BOM

A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Manufacturing Plan

Information detailing the tools, processes, and material forms that will be used to build the desired ACSPs.

Shop Floor Work Package

Documentation containing the shop floor authorization to perform the work, detail planning, and any documentation required to identify any planning or operational deviations.

Tools

All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

NC Programs

A set of machine instructions written in a appropriate language which are intended to control a machine for a manufacturing activity.

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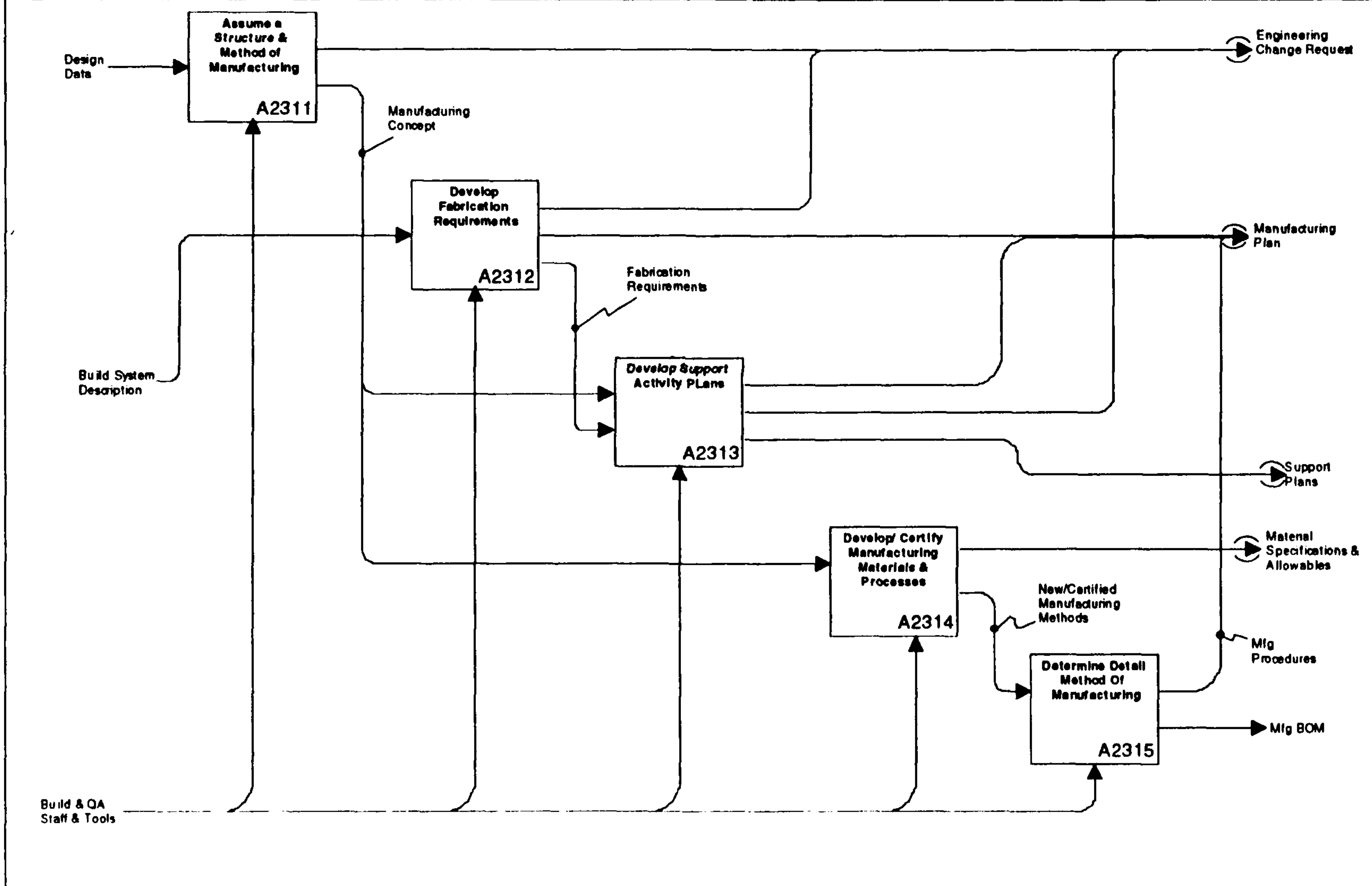
	NODE: A231	TITLE: Plan For Manufacture			



168

A231: Plan For Manufacture

Activities:

A2311 Assume a Structure & Method of Manufacturing

Establish production breaks, Major Unit configurations, & major subassemblies, make tentative make or buy decisions and a tooling & assembly overall plan.

A2312 *Develop Fabrication Requirements*

Estimate resource needs, cost to purchase or make, and timing to start-up and production.

A2313 Develop Support Activity Plans

Develop a top level plan of production including assembly, tooling and space, and detail ACSP fabrication requirements.

A2314 Develop/Certify Manufacturing Materials & Processes

Develop a *strategy* plan for meeting QA requirements, Materials plans, tooling policy, approach, and major requirements, facilities & equipment requirements, and Personnel Requirements.

A2315 Determine Detail Method Of Manufacturing

Define a manufacturing bill of materials (BOM) and for each item of that BOM define a manufacturing method and vendor purchase plan.

Inputs:

I1 Build System Description
The "as-built" configuration of a product. Includes certification of materials and processes, part inspection results, rework/repair operations, and verification f all production/inspection steps.

I2 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

Outputs:

O1 Manufacturing Plan
Information detailing the tools, processes, and material forms that will be used to build the desired ACSPs.

O2 Mfg BOM
A complete manufacturing indentured part list *including all the parts and sub-parts as sen* by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

O3 Manufacturing Concept
Documented approach showing how the ACSP will be manufactured.

O4 Manufacturing Plan
Information detailing the tools, processes, and material forms that will be used to build the desired ACSPs.

O5 Engineering Change Request
Document requesting Engineering to investigate and/or correct any design deficiencies that the ACSP difficult or impossible to build.

O6 Fabrication Requirements
Definition of the required steps to fabricate an ACSP.

Controls:

C1 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated with these activities.

C2 Specifications & Standards
Documentation *showing the required steps that must be followed in order* to correctly perform an activity. Also shows allowed deviations.

C3 Composite Product Development Constraints
Limiting factors on the development of a composite product.

Mechanisms:

M1 Build & QA Staff & Tools

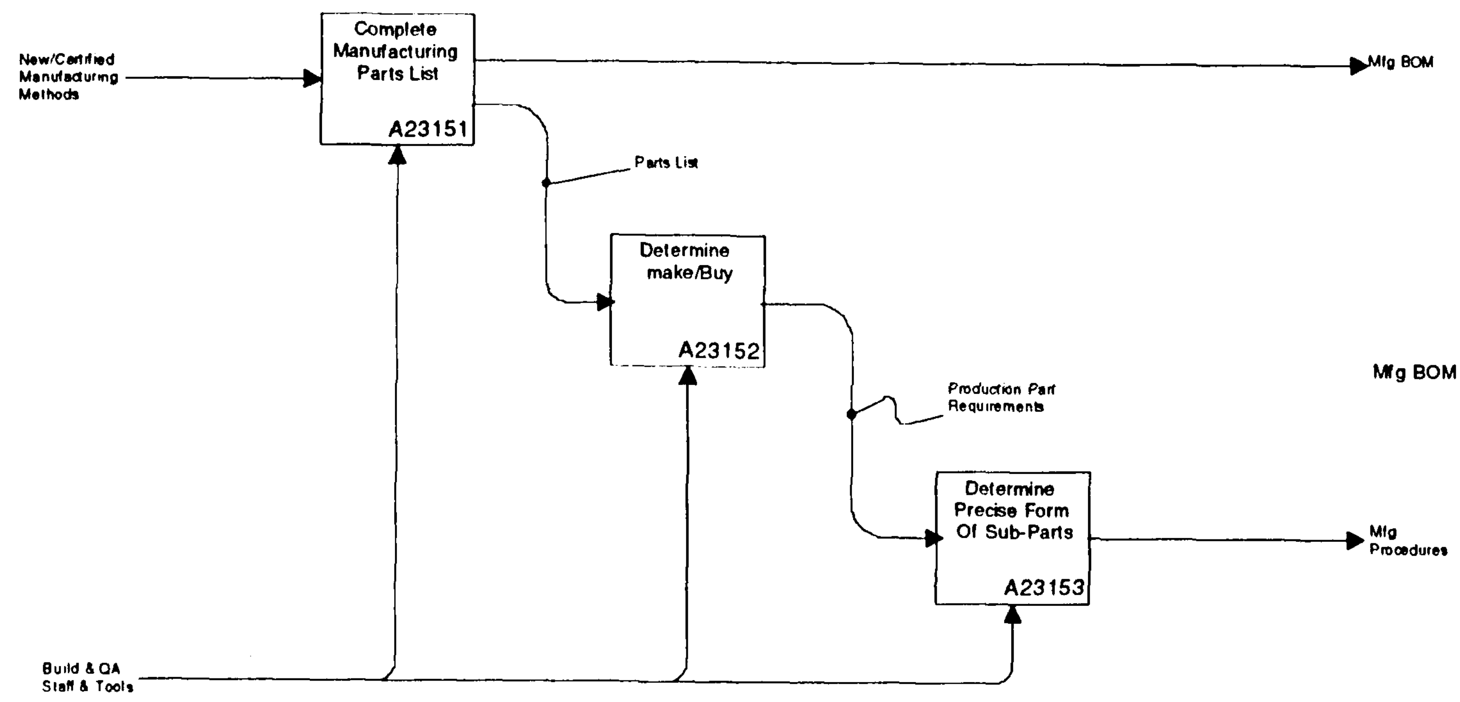
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Fabrication Requirements

Definition of the required steps to fabricate an ACSP.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION
	NODE: A2315	TITLE: Determine Detail Method Of Manufacturing		CONTEXT:



177

A2315: Determine Detail Method Of Manufacturing

Activities:

A23151 Complete Manufacturing Parts List

The parts list per the manufacturing breakdown is completed.

A23152 Determine Make/Buy

Whether to make or buy the ACSPs on the parts list is determined based upon program parameters, ACSP complexity, and economic factors.

A23153 Determine Precise Form Of Sub-Parts

Determine the form of sub-parts (e.g., forged, cast, sheet stock, etc.). that will provide the most economical production of an ACSP that meets all design requirements. The form of sub-parts may change during the life cycle of a program.

Inputs:

I1 New/Certified Manufacturing Methods
Any manufacturing methods that have been given official approval for production use.

Outputs:

O1 Mfg Procedures
A proven plan of how a engineering process specification can be achieved with an actual manufacturing process.

O2 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Controls:

(None)

Mechanisms:

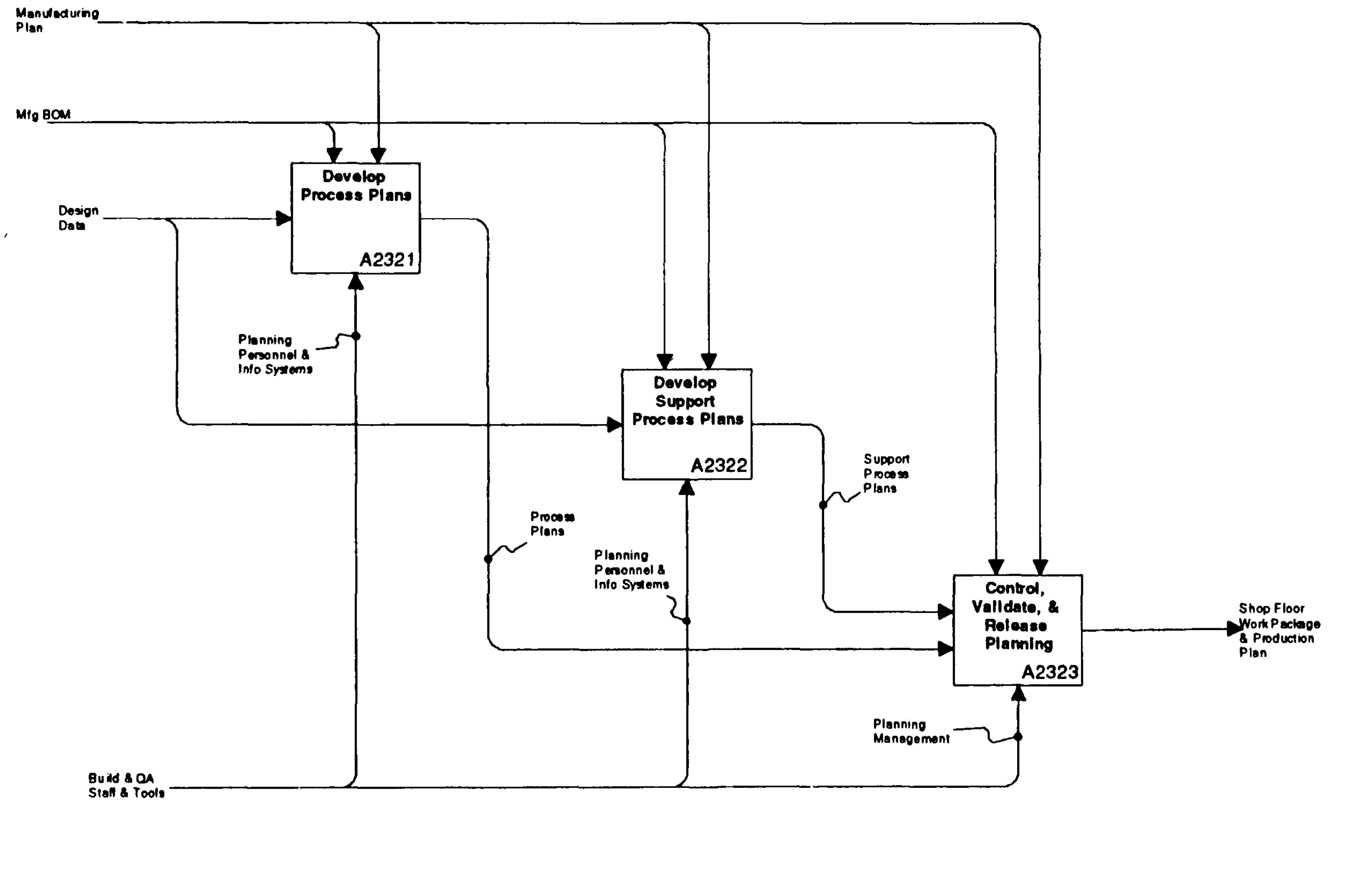
M1 Build & QA Staff & Tools
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Parts List
A listing of the part identifying numbers.

Production Part Requirements
Defines what ACSPs must be produced and when in order to meet delivery schedules.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
			I	DRAFT		PUBLICATION	
	NODE: A232	TITLE: Develop Production Plan					



17V

A232: Develop Production Plan

C1 **Activities:**

A2321 Develop Process Plans

Define the detail of the assembly and manufacturing methods and sequence such that it can be released to the shop.

A2322 Develop Support Process Plans

Define Plans for support activities such as materials, quality assurance, tooling, facilities, equipment, and personnel.

A2323 Control

Perform the administrative and managerial tasks necessary to assure that the planning is current with engineering definition and properly approved for production.

Inputs:

I1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

Outputs:

O1 Shop Floor Work Package & Production Plan
Documentation containing the shop floor authorization to perform the work, detail planning, and any documentation required to identify any planning or operational deviations and the Production Plan.

Controls:

C1 Composite Product Development Constraints
Limiting factors on the development of a composite product.

C2 Specifications & Standards
Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

C3 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated withC3 these activities.

C4 Manufacturing Plan
Information detailing the tools, processes, and material forms that will be used to build the desired ACSPs.

C5 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Mechanisms:

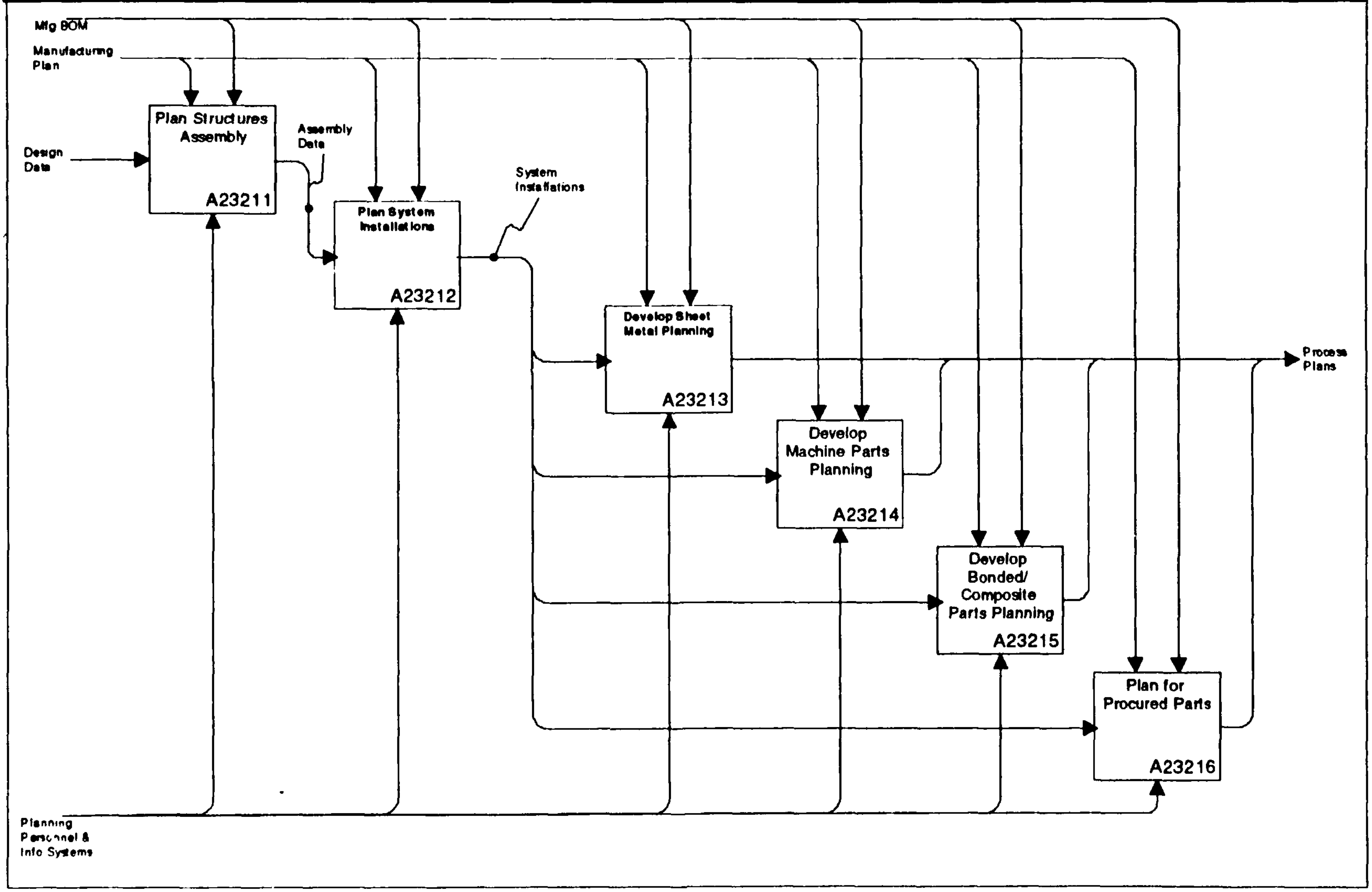
M1 Build & QA Staff & Tools
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Process Plans
Detail instructions on how work is to be performed including routing, specifications to control the work, and a complete definition of what is to be accomplished at each production step. Also includes manufacturing documentation requirements.

Support Process Plans
Detail instructions for manufacturing support activities such as quality assurance, inspection, and testing. It also includes sequencing & routing information in relation to other process plans.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00		WORKING		RECOMMENDED
			X	DRAFT		PUBLICATION
	NODE: A2321	TITLE: Develop Process Plans				CONTEXT:



A2321: Develop Process Plans

Activities:

A23211 Plan Structures Assembly

Define the installation steps necessary to assemble the structure as well as define tools required.

A23212 Plan System Installations

Define the installation steps to install systems (electronic & hydraulic) as well as define tools required.

A23213 Develop Sheet Metal Planning

Define fabrication of parts from cutting and forming sheet metal. (This process is included for reference purposes only and will not be decomposed.)

A23214 Develop Machine Parts Planning

Define Machine Parts Fabrication including NC Programs, holding and cutting tools, and set-ups. (This process is included for reference purposes only and will not be decomposed.)

A23215 Develop Bonded/ Composite Parts Planning

Define Composite Part Fabrication detail planning.

A23216 Plan for Procured Parts

Add manufacturing requirements for procured parts.

Inputs:

C1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

Outputs:

O1 Process Plans
Detail instructions on how work is to be performed including routing, specifications to control the work, and a complete definition of what is to be accomplished at each production step. Also includes manufacturing documentation requirements.

Controls:

C1 Manufacturing Plan
Information detailing the tools, processes, and material forms that will be used to build the desired ACSPs.

C2 Mfg BOM
A complete manufacturing indentured part *list including all the parts and sub-parts* as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Mechanisms:

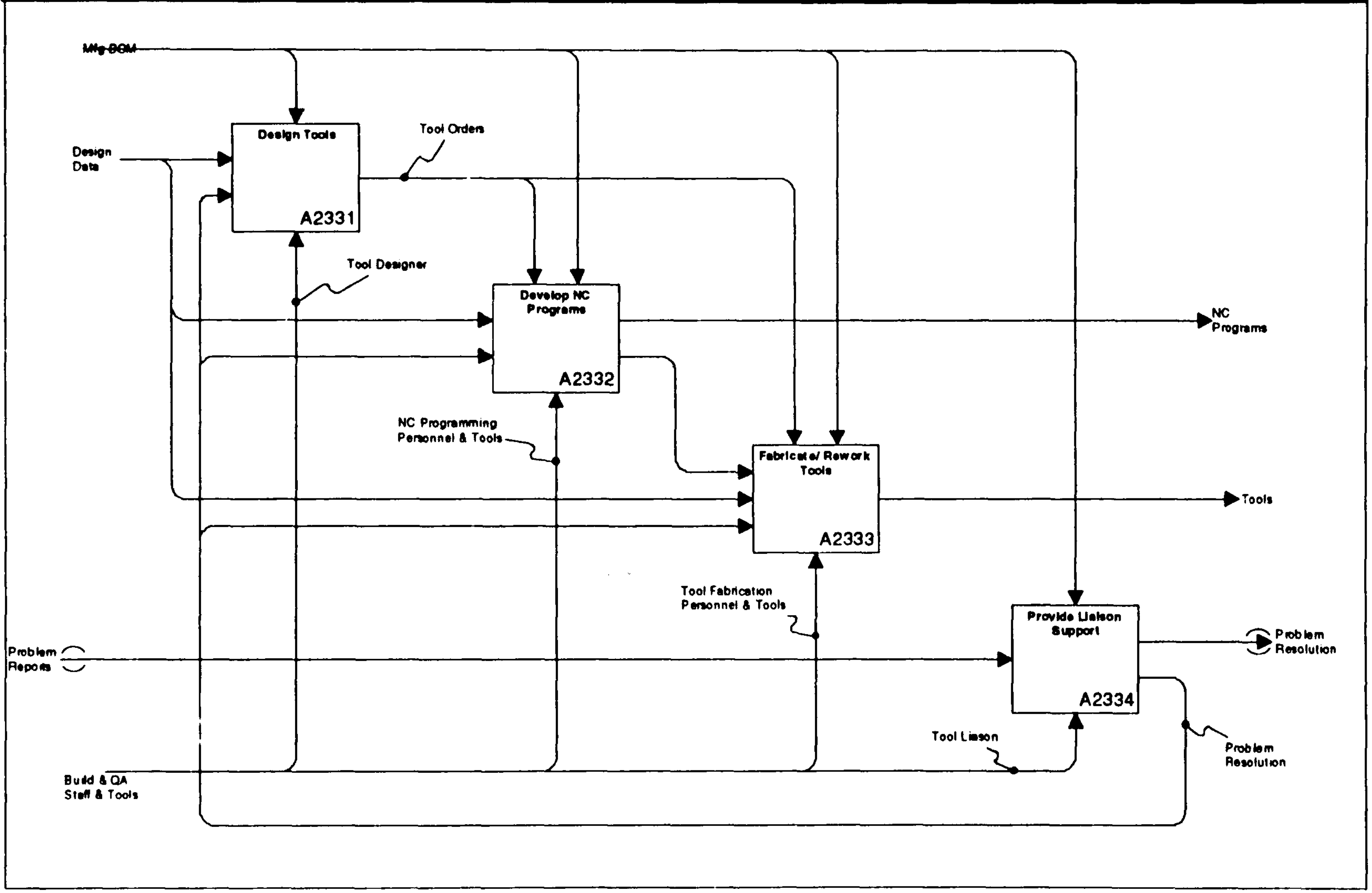
M1 *Planning Personnel & Info Systems*
Planning management, programmers, and any computer systems/hardware used to perform this activity.

Process Interactions:

Assembly Data
Definition of the assembly operations required to attach the ACSP to the next higher level assembly.

System Installations
Documents the identity of the next higher level installation for the ACSP.

USED AT:	AUTHOR: PAS-C Team & Experts	DATE: 12/17/91		WORKING		RECOMMENDED	CONTEXT:
LTV, GD & Boeing	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A233	TITLE: Provide Tools					



172

A233: Provide Tools

Activities:

A2331 Design Tools
Provide engineering definition of tools.

A2332 Develop NC Programs
Provide the Numerical Control Programs needed to fabricate tools.

A2333 Fabricate/ Rework Tools
Make and/or refurbish tools.

A2334 Provide Liaison Support
Support tool fabrication and tool tryout in production by providing expertise and resolution of problems.

Inputs:

Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

Problem Reports
All information regarding a part or process that does not fall within accepted limits or may be improved or modified. This includes, but is not limited to, incomplete operation reports, discrepancy reports, requests for engineering investigations, request for planning changes, and requests for changes to tooling.

Outputs:

O1 Tools
Manufacturing aids used to build an ACSP.

O2 NC Programs
A set of machine instructions written in a appropriate language which are intended to control a machine for a manufacturing activity.

O3 Problem Resolution
Information describing what action must be taken in order to resolve a given problem.

Controls:

C1 Composite Product Development Constraints
Limiting factors on the development of a composite product.

C2 Specifications & Standards
Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

C3 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated with these activities.

C4 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Mechanisms:

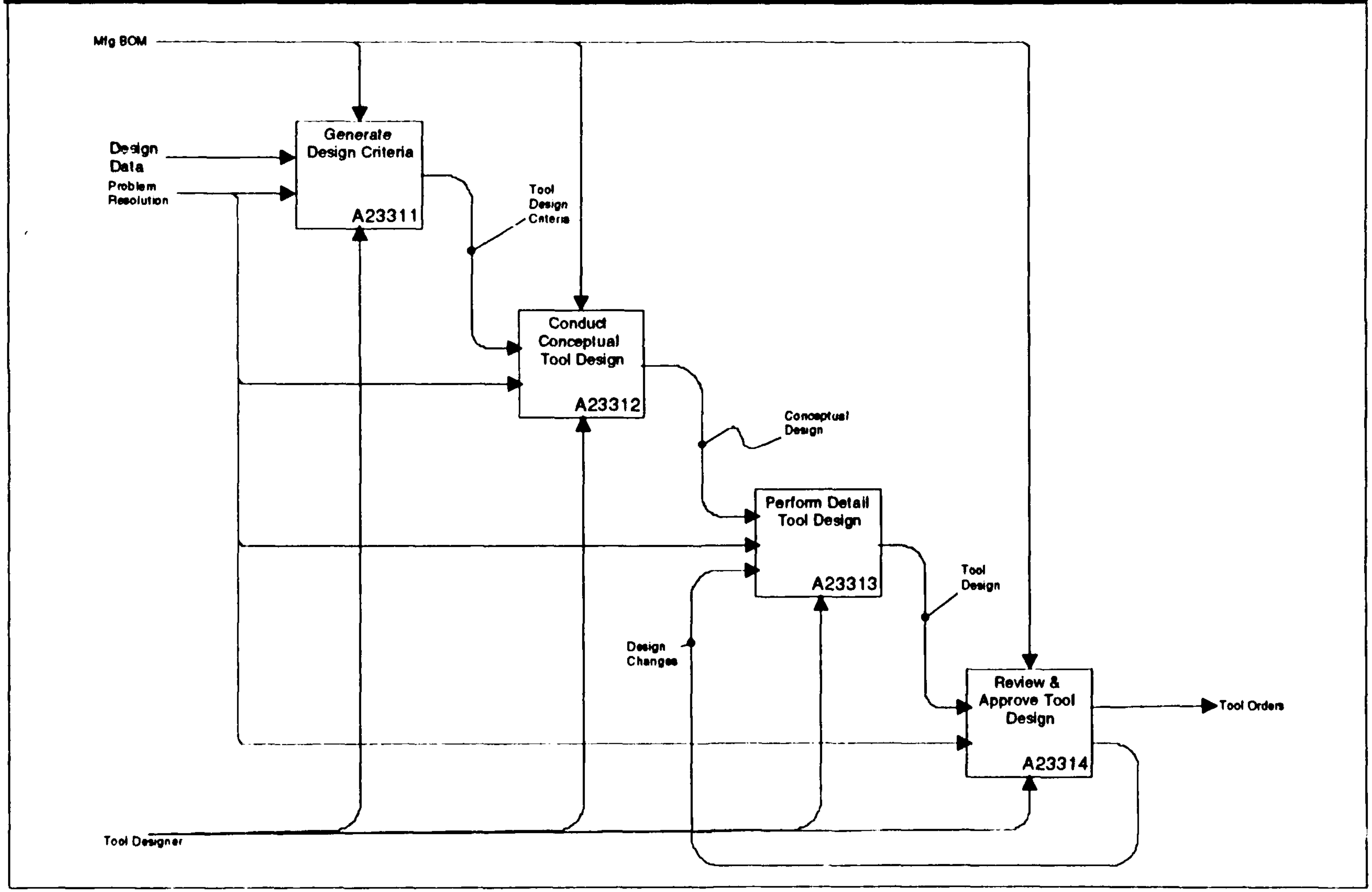
M1 Build & QA Staff & Tools
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Tool Orders
Request that tooling operations be completed either to rework or fabricate a tool required to build an ACSP.

NC Programs
A set of machine instructions written in a appropriate language which are intended to control a machine for a manufacturing activity.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A2331	TITLE: Design Tools			



A2331: Design Tools

Activities:

A23311 Generate Design Criteria

Conduct a tooling producibility review which creates a design criteria and a request to design a tool.

A23312 Conduct Conceptual Tool Design

Determine the approach to be used for the tool design, including supporting structure type, rigidity required, transportability requirements, autoclave loading and heating requirements, and bagging and pull-down requirements.

A23313 Perform Detail Tool Design

Complete the detail definition of the tool design, including presentation of the design in suitable format.

A23314 Review & Approve Tool Design

Validate Tool Design fit, form, & function . Validate tool design to product design. Release tool design to manufacture.

Inputs:

I1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

I2 Problem Resolution
Information describing what action must be taken in order to resolve a given problem.

Outputs:

O1 Tool Orders
Request that tooling operations be completed either to rework or fabricate a tool required to build an ACSP.

Controls:

C1 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Mechanisms:

M1 Tool Designer
Personnel who perform the tool design processes. Also includes any information systems/computer equipment used to perform this activity.

Process Interactions:

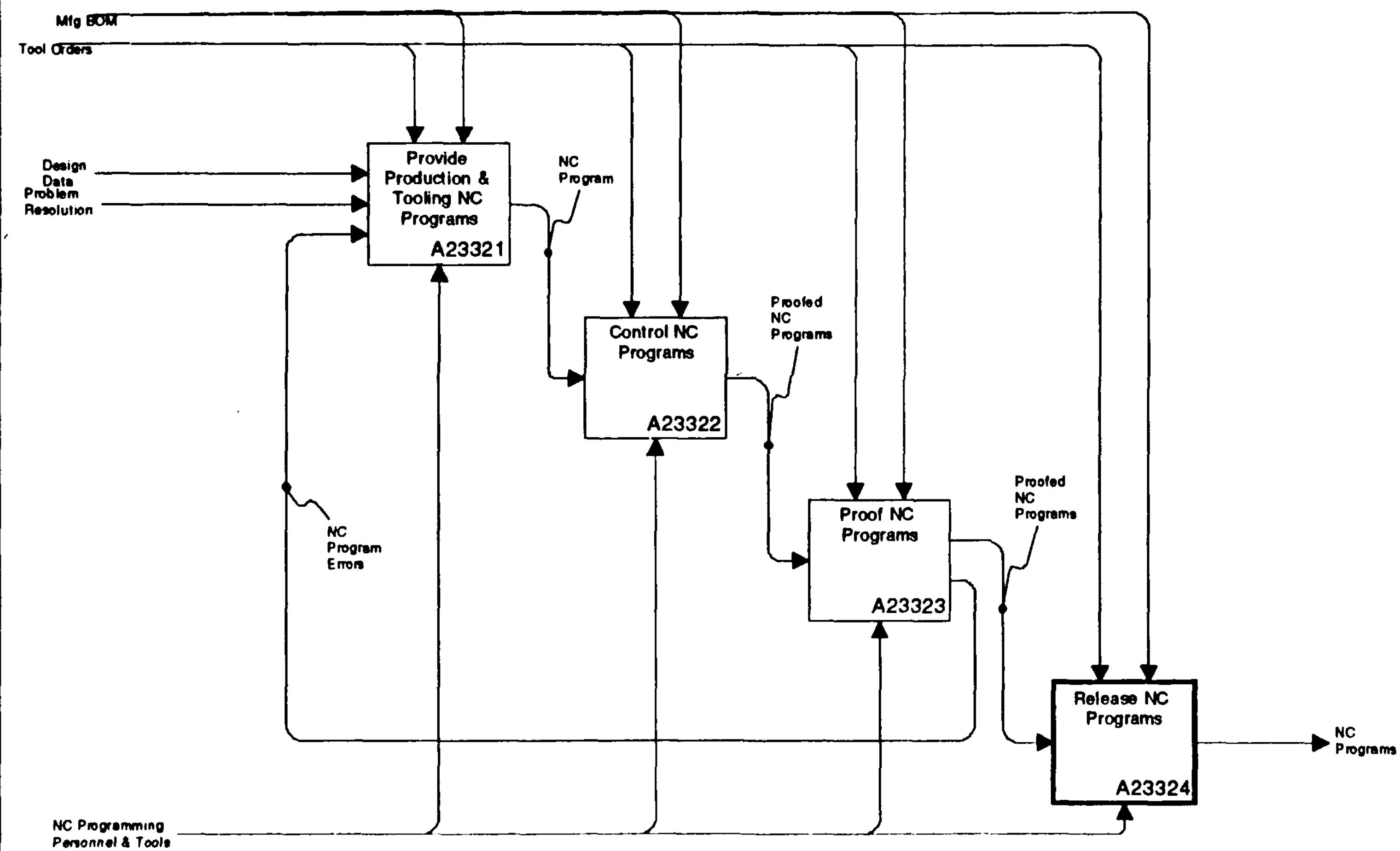
Tool Design Criteria
A definition of the role the tool must perform in the manufacturing cycle and the corresponding parameters the tool must meet in order to fill that role. Includes life expectancy and general functionality.

Conceptual Design
Ask Mike

Contoured Skin Laminate
CSL

Tool Design Criteria
A definition of the role the tool must perform in the manufacturing cycle and the corresponding parameters the tool must meet in order to fill that role. Includes life expectancy and general functionality.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00	[ ] WORKING [X] DRAFT	[ ] RECOMMENDED [ ] PUBLICATION	CONTEXT:
	NODE: A2332	TITLE: Develop NC Programs			



A2332: Develop NC Programs

Sub-Activities:

A23321 Provide Production & Tooling NC Programs

Develop and Debug NC programs to perform inspection operations (inspect tool designs and ACSPs), and perform fabrication operations (ACSPs and tools).

A23322 Control NC Programs

Provide serialized identification and validate the configuration of the program for the desired application.

A23323 Proof NC Programs

Schedule NC proofing and validate Tool NC program by simulation or on machine.

A23324 Release NC Programs

Transfer NC media to tool Fabrication Storage.

Inputs:

I1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

I2 Problem Resolution
Information describing what action must be taken in order to resolve a given problem.

Outputs:

O1 NC Programs
A set of machine instructions written in a appropriate language which are intended to control a machine for a manufacturing activity.

Controls:

C1 Tool Orders
Request that tooling operations be completed either to rework or fabricate a tool required to build an ACSP.

C2 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Mechanisms:

M1 NC Programming Personnel & Tools
NC management, programmers, and any computer systems/hardware used to perform this activity.

Process Interactions:

NC Programs
Proofed NC Programs

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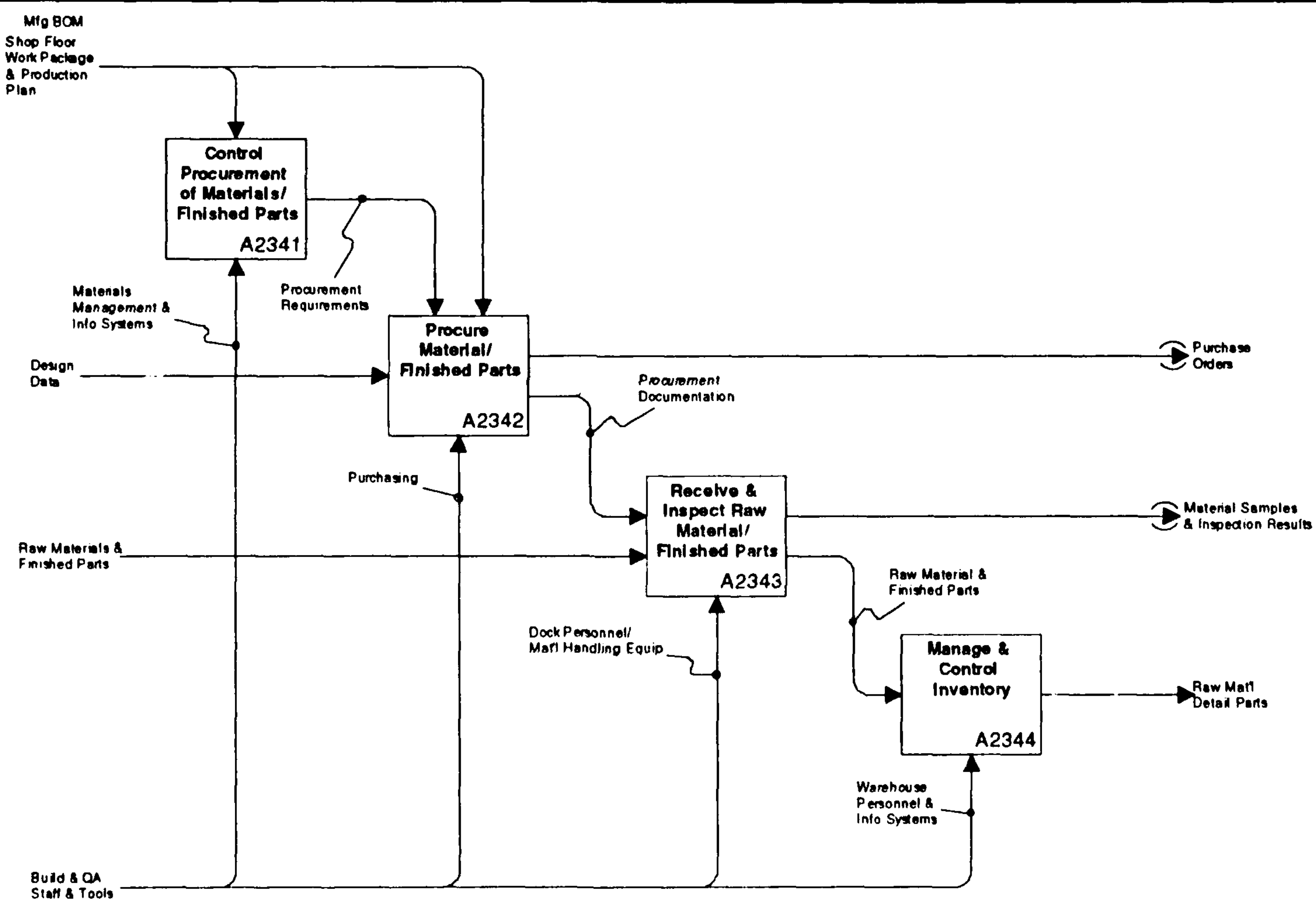
			X	DRAFT		PUBLICATION	
	NODE: A234	TITLE: Procure Manufacturing Materials					



A234: Procure Manufacturing Materials

Activities:

A2341 Control Procurement of Materials/Finished Parts

Identify the material types, quantities, and date needed for all materials required to build an ACSP. Involves certifying vendors, generating purchase orders, and monitoring the procurement process.

A2342 Procure Material/ Finished Parts

Generate the required purchase orders and order materials from approved vendors.

A2343 Receive & Inspect Raw Material/ Finished Parts

Receive materials, and process and record critical information about the raw materials required to build composite parts. The operations include unloading and storing the materials and verifying that the materials were transported in an approved fashion. As in the case of refrigerated materials, that the proper temperature was maintained. Suitable test samples are taken and sent to the test lab.

A2344 Manage & Control Inventory

Provide segregated storage space for bonded (not certified for use) and material available for use. Provide accurate inventories and monitor the usage critical materials.

Inputs:

I1 Design Data
Information that conveys the part design to manufacturing. Includes part lists, material requirements, engineering drawings, etc.

I2 Raw Materials & Finished Parts
All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

Outputs:

O1 Raw Material/Part Details
All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

Controls:

C1 Composite Product Development Constraints
Limiting factors on the development of a composite product.

C2 Specifications & Standards
Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

C3 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated with these activities.

C4 Shop Floor Work Package & Production Plan
Documentation containing the shop floor authorization to perform the work, detail planning, and any documentation required to identify any planning or operational deviations and the Production Plan.

C5 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

Mechanisms:

M1 Build & QA Staff & Tools
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Procurement Requirements

Define what materials must be purchased and when to meet production schedules.

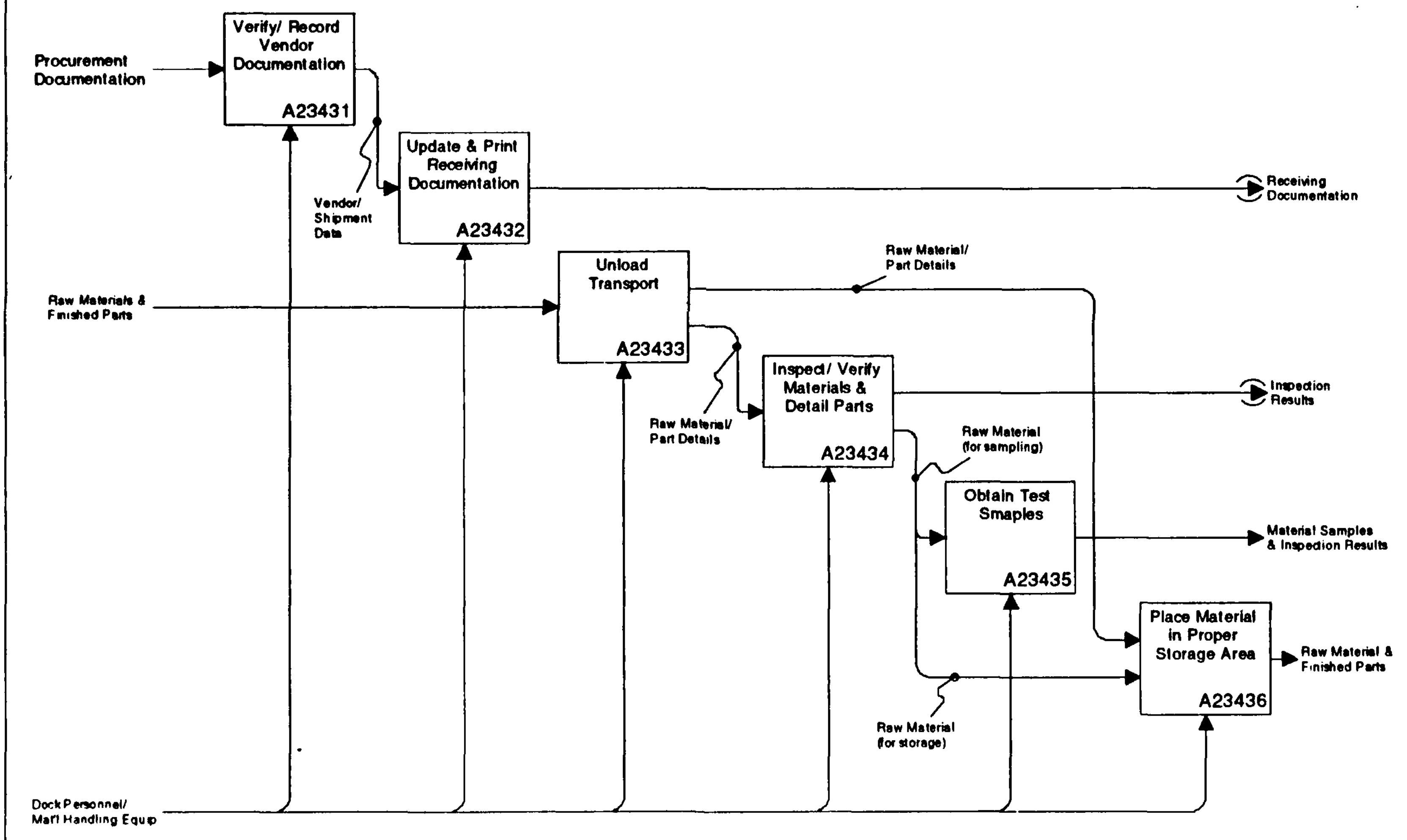
Procurement Documentation

Information from the manufacturer of the raw material that was purchased. Documents what was purchased.

Raw Materials & Finished Parts

All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A2343	TITLE: Receive & Inspect Raw Material/ Finished Parts			



A2343: Receive & Inspect Raw Material/ Finished Parts

Activities:

A23431 Verify/ Record Vendor Documentation

The information from the vendor must be verified as to the content of the shipment and the count/condition. Warehouse personnel verify the contents of the shipment and match that information against the shipper documentation.

A23432 Update & Print Receiving Documentation

The appropriate internal documentation recording the vendor, batch/lot, and material code are printed and placed with the material for identification.

A23433 Unload TransportC2

The contents of the transport are removed and placed in an inspection area.

A23434 Inspect/ Verify Materials & Detail Parts

The contents are inspected per the inspection plan for that type of material. This inspection is to verify that the shipping documentation accurately reflects what was shipped, materials were not damaged and properly handled during shipment and the material meets the basic requirements set forth in the inspection plan.

A23435 Obtain Test Samples

Most raw materials will have a sample randomly removed and sent to the test lab. Results of the inspection are recorded and determine if the material may be released for production use. This requires thawing of the frozen material.

A23436 Place Material in Proper Storage Area

After the inspection is completed and the test samples are removed the material will be placed into the proper storage area. Storage areas for cold storage must remain at or near 0 degree F. Ambient material must be stored in a clean, dry environment.

Inputs:

I1 Procurement Documentation
Information from the manufacturer of the raw material that was purchased. Documents what was purchased.

I2 Raw Materials & Finished Parts
All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

Outputs:

O1 Raw Materials & Finished Parts
All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

O2 Material Samples & Inspection Results
Portions of a raw material delivery that were separated and will be used for testing purposes and the results of the inspection activities.

Controls:

(None)

Mechanisms:

M1 Dock Personnel/ Mat'l Handling Equip
Personnel who perform the activities on the warehouse dock and any mechanical devices used to help them move heavy objects.

Process Interactions:

Vendor/Shipment Data

Information defining the materials that were sent by the vendor.

Raw Material/Part Details

All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

Raw Material (For Sampling)

Material that has been separated for the purpose of removing a portion of the material for testing.

C4 **Mfg BOM**
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

C5 **Composite Product Development Constraints**
Limiting factors on the development of a composite product.

Mechanisms:

M1 **Tools**
Manufacturing aids used to build an ACSP.

M2 **Build & QA Staff & Tools**
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

M3 **NC Programs**
A set of machine instructions written in a appropriate language which are intended to control a machine for a manufacturing activity.

Process Interactions:

ACSP (not cured)
An ACSP that has been layup and/or assembled but has not been cured.

ACSP (cured)
A cured ACSP part.

ACSP (complete)
An ACSP after all fabrication operations have been completed.

A235: Produce Product (ACSP)

Activities:

A2351 Perform Production Operations

The materials and tools required to produce the ACSP's are located and taken to the proper work station. the operations required to build the ACSP are performed and the ACSP is cured. The cured ACSP is then trimmed and drilled as required and then inspected to verify the processes involved. Quality assurance steps are executed during every step of the process.

A2352 Cure & Tear Down ACSP

The part is placed in the appropriate curing equipment and the appropriate sensor are attached. the curing cycle is completed, validated, and recorded and the ACSP is removed. The ACSP is separated from the bagging materials and the tooling. The ACSP is transported to the next operation and the tools returned to storage.

A2353 Trim & Drill ACSP

The periphery, internal cutouts, and holes are cut/drilled manually and using automated equipment.

A2354 Assure Product Quality

All composite parts have the dimensions and internal structure of the parts inspected Also the materials, tools, and personnel involved are certified.

Inputs:

I1 Raw Material Detail Parts

All material that are required to procure an ACSP. This includes, but is not limited to, all prepregs, core, potting compounds, adhesives, bagging materials, shop supplies and any parts supplied by a vendor or internal detail fabrication steps.

Outputs:

O1 ACSP & Part Definition Package

An ACSP and the accompanying information package that defines the part for the customer.

O2 Build Change Requests

Requests to make modifications to the build data.

03 Anomaly Reports

All information regarding a part or process that does not fall within accepted limits or may be improved or modified. This includes, but is not limited to, incomplete operation reports, discrepancy reports, requests for engineering investigations, request for planning changes, and requests for changes to tooling.

O4 ACSP & Part Definition Package

An ACSP and the accompanying information package that defines the part for the customer.

Controls:

C1 Specifications & Standards

Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

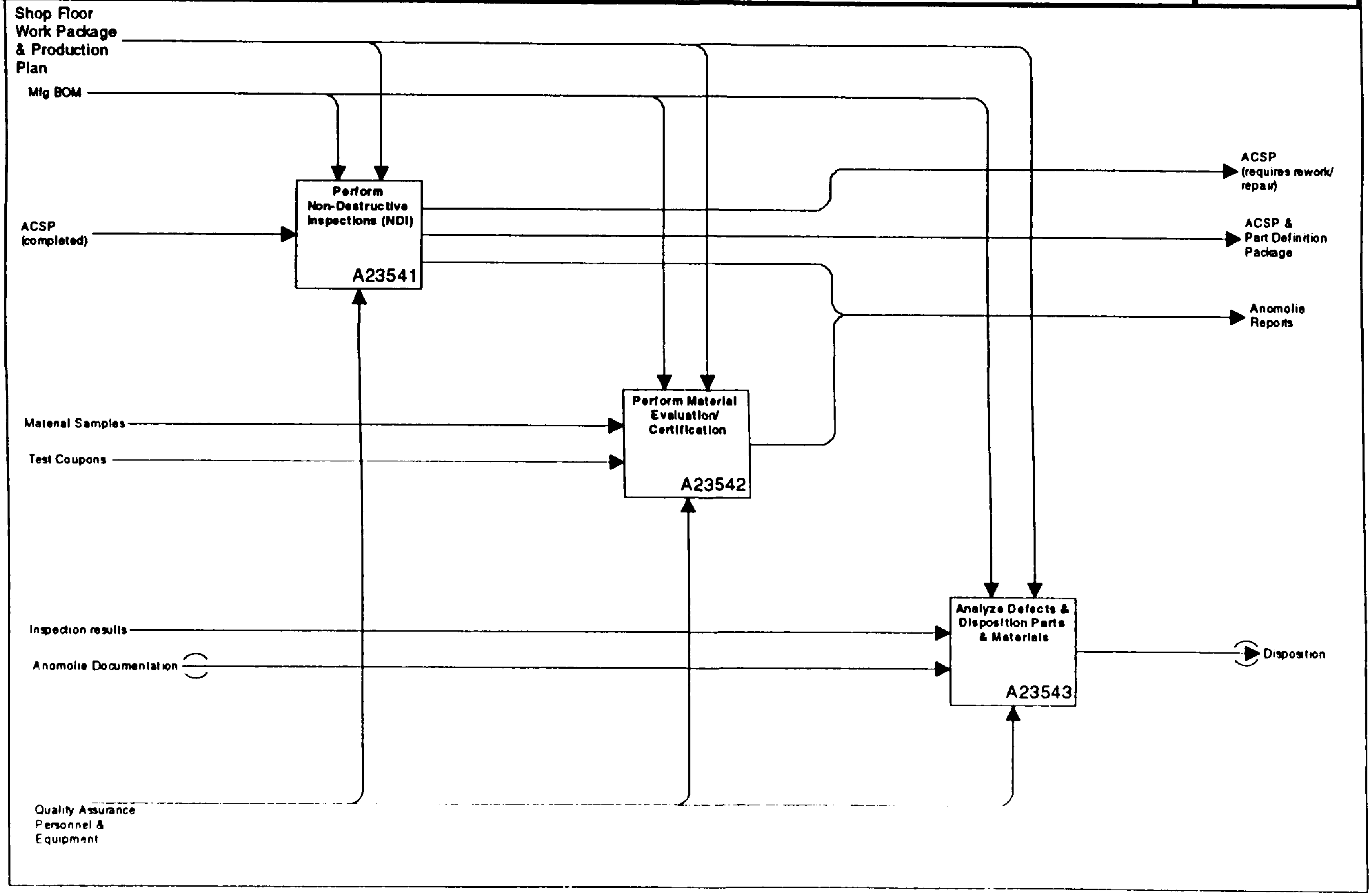
C2 Budget & Schedule

The amount of funding and time frame requirements to complete the tasks associated with these activities.

C3 Shop Floor Work Package & Production Plan

Documentation containing the shop floor authorization to perform the work, detail planning, and any documentation required to identify any planning or operational deviations and the Production Plan.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A2354	TITLE: Assure Product Quality			



A2354: Assure Product Quality

Activities:

A23541 Perform Non-Destructive Inspections (NDI)

Verify that there are no voids, delaminations, porosity, cracks etc. are contained within the structure of the part. Also verify that all parts dimensions are within allowed tolerances.

A23542 Perform Material Evaluation/ Certification

All materials used in the manufacture of composite parts must be evaluated and certified prior to use. These tests evaluate the physical and mechanical properties of the materials and determine if they fall within accepted limits.

A23543 Analyze Defects & Disposition Parts & Materials

The results of the inspections and tests that failed are carefully analyzed to determine if and how the problem can be corrected.

Inputs:

ACSP (compete)
An ACSP after all fabrication operations have been completed.

C1 Test Coupons
Portions of a cured composite part that were separated from the part during trim operations. Will be tested to ensure that the cure process was properly completed.

C2 Material Samples & Inspection Results
Portions of a raw material delivery that were separated and will be used for testing purposes and the results of the inspection activities.

C3 Anomaly Documentation
All information regarding a part or process that does not fall within accepted limits or may be improved or modified. This includes, but is not limited to, incomplete operation reports, discrepancy reports, requests for engineering investigations, request for planning changes, and requests for changes to tooling.

Outputs:

O1 ACSP & Part Definition Package
An ACSP and the accompanying information package that defines the part for the customer.

O2 Anomaly Reports
All information regarding a part or process that does not fall within accepted limits or may be improved or modified. This includes, but is not limited to, incomplete operation reports, discrepancy reports, requests for engineering investigations, request for planning changes, and requests for changes to tooling.

O3 ACSP (requires rework/repair)
An ACSP that did not pass inspection and requires additional fabrication steps in order to be accepted.

O4 Disposition
Determination of the additional effort, if any, required to make an ACSP conform to the design constraints.

Controls:

C1 Shop Floor Work Package & Production Plan
Documentation containing the shop floor authorization to perform the work, detail planning, and any documentation required to identify any planning or operational deviations and the Production Plan.

C2 Mfg BOM
A complete manufacturing indentured part list including all the parts and sub-parts as sen by manufacturing. This parts list corresponds to manufacturing needs for segregation of work to production orders.

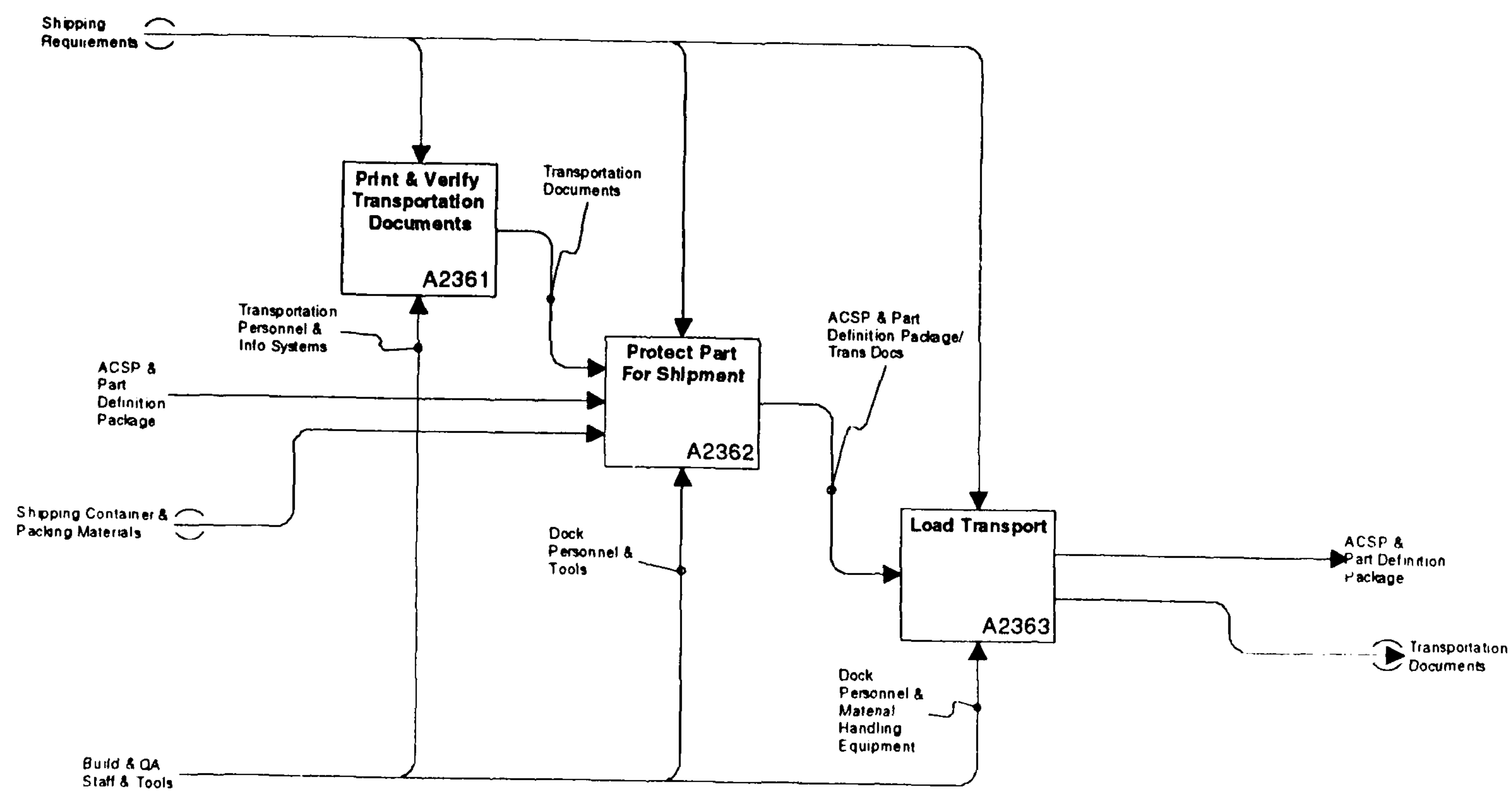
Mechanisms:

M1 QA Personnel & Equipment
Personnel who perform the inspection processes and buy-off the production operations. Also includes the inspection equipment (ultrasonics, x-ray, etc.) and information systems/computer equipment used to perform this activity.

Process Interactions:

None

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/17/91 REV: 00	 X	WORKING DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A236	TITLE: Ship Product				



A236: Ship Product

Activities:

A2361 Print & Verify Transportation Documents

Information about the part must be printed or transferred to a medium that allow the data to be transmitted to the next operation or the customer. For transfer to subsequent operations the planning and manufacturing data must be verified. For parts to the customer all critical build and manufacturing data must be provided.

A2362 Protect Part For Shipment

The part will be wrapped in a protective layer of a protective material, usually bubble wrap. If the part is to be transported outside the plant, a suitable transportation container is used.

A2363 Load Transport

The part is placed on an appropriate transport vehicle and secured as to prevent damage or load shift during transport.

Inputs:

I1 ACSP & Part Definition Package
An ACSP and the accompanying information package that defines the part for the customer.

I2 Shipping Container & Packing Materials
The container & materials required when packaging an ACSP for shipment. For example, bubble wrap and wooden crates.

Outputs:

O1 ACSP & Part Definition Package
An ACSP and the accompanying information package that defines the part for the customer.

Controls:

C1 Composite Product Development Constraints
Limiting factors on the development of a composite product.

C2 Specifications & Standards
Documentation showing the required steps that must be followed in order to correctly perform an activity. Also shows allowed deviations.

C3 Budget & Schedule
The amount of funding and time frame requirements to complete the tasks associated with these activities.

Mechanisms:

M1 Build & QA Staff & Tools
All personnel associated with the build and QA activity. Also includes all tools including, but not limited to, computer hardware/software, NC programs, production tools, inspection equipment, material handling devices, and hand tools.

Process Interactions:

Transportation Documents
Documentation required by the carrier. Includes Bill of Lading, invoices, etc.

ACSP & Part Definition Package/TransDocs
An ACSP and the accompanying information package that defines the part for the customer and the appropriate transportation documents.

2.3.5 Part Specific

The part specific activities identified on the General ACSP node tree diagram (Dwg. # PAS-C-01) have been arranged into the three major functional views. Due to scoping constraints, the build view IDEF0 diagrams have been omitted. The design and analysis views IDEF0 diagrams are included in the following pages.

Based on the node numbering sequence for part specific nodes, as described in section 2.3.3, the typical ACSP has been decomposed to represent the three part families selected from the FW/BB matrix. They are T Composite Analysis (TCA), Contoured Skin Laminate (CSL) and Core Stiffened Panel (CSP). Based on these part family perspectives the Design and Analysis activities that are affected as shown in the node tree in:

- Design ACSP — Dwg. # PAS-C-03 Sheet 2 of 2
- Preliminary and Detail ACSP Analysis — Dwg. # PAS-C-02 Sheet 2 of 2

and also in the indentured lists which precedes the sections IDEF0 diagrams glossary. The general style of the pages in the following sections is as was described in section 2.3.4.

PART SPECIFIC - DETAIL DESIGN

Part Specific Design Activity Listing

A231 Create TCA Data
A2311 Prepare TCA Angle Design
A23111 Resolve TCA Angle Mfg. Process
A23112 Resolve TCA Angle Part Periphery
A23113 Resolve TCA Angle Target Layup Orientation
A23114 Resolve TCA Angle Target Thickness
A23115 Determine TCA Angle Ply Counts
A23116 Produce TCA Angle Ply Stack-Up
A231161 Resolve TCA Angle Ply Sequence
A231162 Create TCA Angle Ply Tables
A2311621 Attach TCA Angle Part Numbers
A2311622 Attach TCA Angle Ply Numbers
A2311623 Attach TCA Angle Material Flagnotes
A2311624 Attach TCA Angle Fiber Orientation
A2311625 Attach TCA Angle Splice Flagnote
A2311626 Attach TCA Angle Revision Letter
A231163 Develop TCA Angle Ply Periphery
A231164 Attach TCA Angle Ply Callouts
A2312 Prepare TCA Cap Design
A2313 Prepare TCA Filler Design
A23131 Resolve TCA Filler Geometry Envelope
A23132 Resolve TCA Filler Build/TTU/Quality Issues
A23133 Build TCA Filler Detail Drawing
A232 Create CSL Data
A2321 Resolve CSL Mfg. Process
A2322 Resolve CSL Part Periphery
A2323 Resolve CSL Target Lay-up Orientation
A2324 Resolve CSL Target Thickness area
A2325 Determine CSL Ply Counts
A2326 Produce CSL Ply Stack-Up
A23261 Resolve CSL Ply Sequence
A23262 Create CSL Ply Tables
A232621 Attach CSL Part Numbers
A232622 Attach CSL Ply Numbers
A232623 Attach CSL Material Flagnotes
A232624 Attach CSL Fiber Orientation
A232625 Attach CSL Splice Flagnote
A232626 Attach CSL Revision Letter
A23263 Develop CSL Ply Periphery
A23264 Attach CSL Ply Callouts
A233 Create CSP Data

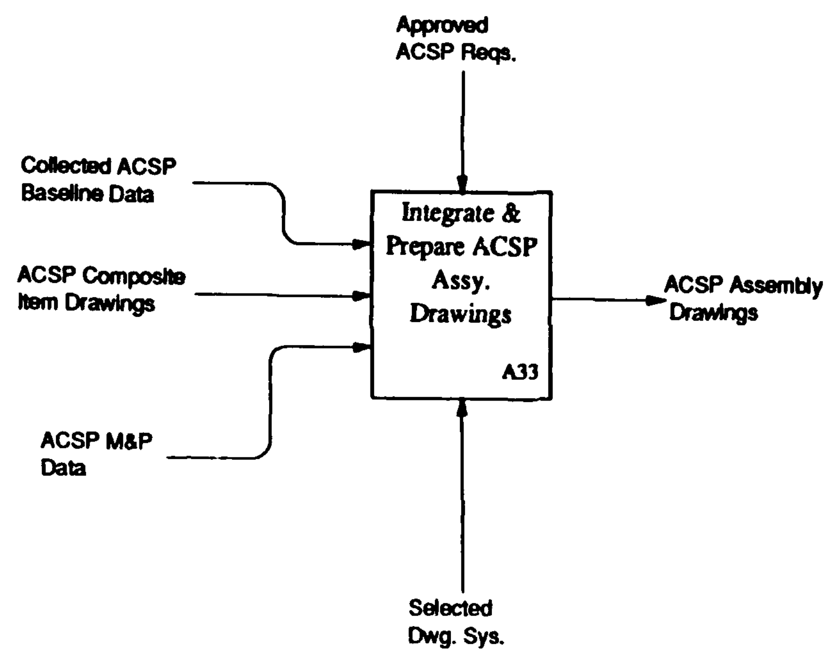
A2331 Prepare CSP Skin Details
A23311 Resolve CSP Skin Mfg. Process
A23312 Resolve CSP Skin Part Periphery
A23313 Resolve CSP Skin Target Layup Orientation
A23314 Resolve CSP Skin Target Thickness
A23315 Determine CSP Skin Ply Counts
A23316 Produce CSP Skin Ply Stack-Up
A233161 Resolve CSP Skin Ply Sequence
A233162 Create CSP Skin Ply Tables
A2331621 Attach CSP Skin Part Numbers
A2331622 Attach CSP Skin Ply Numbers
A2331623 Attach CSP Skin Material Flagnotes
A2331624 Attach CSP Skin Fiber Orientation
A2331625 Attach CSP Skin Splice Flagnote
A2331626 Attach CSP Skin Revision Letter
A233163 Develop CSP Skin Ply Periphery
A233164 Attach CSP Skin Ply Callouts
A2332 Prepare CSP Core Details
A23321 Collect & Layout CSP Core Geometry
A23322 Develop CSP Core Periphery
A233221 Resolve CSP Core Edge Band Issues
A233222 Resolve CSP Core Internal Fittings
A233223 Resolve CSP Core Fillers
A23323 Design CSP Core Thickness, Density & Matl.
A233231 Resolve CSP Core Thickness
A233232 Resolve CSP Core Density
A233233 Resolve CSP Core Material Features
A23324 Design CSP Core Transition Area
A23325 Design CSP Core Ribbon Direction
A2333 Resolve CSP Interfaces
A33 Integrate & Prepare ACSP Assy. Dwg.
A331 Integrate & Prepare TCA Assy. Drawings
A3311 Collect TCA Angle Data
A3312 Collect TCA CAP Data
A3313 Collect TCA Filler D[illegible]
A3314 Prepare TCA Assy. Drawing
A332 Integrate & Prepare CSL Assy. Drawings
A333 Integrate & Prepare CSP Assy. Drawings
A3331 Collect CSP Core & Skin Data
A3332 Resolve CSP Core Adhesive Design
A3333 Resolve CSP Vapor Barrier Design
A3334 Design CSP Item Location for Core, Skins, Padups, Recesses & Holes
A3335 Attach Filler Plies in Transition Areas
A41 Review ACSP Weight, Static, Dynamic & Thermal Analysis

A411 Review TCA Weight, Static, Dynamic & Thermal Analysis
- A4111 Review TCA Cap Analysis
- A4112 Review TCA Angle Analysis
- **A4113 Review TCA Filler Analysis**

A412 Review CSL Weight, Static, Dynamic & Thermal Analysis
- A4121 Review CSL Skin Analysis
- A4122 Review CSL Edge & Fastener Analysis

A413 Review CSP Weight, Static, Dynamic & Thermal Analysis
- A4131 Review CSP Skin Analysis
- A4132 Review CSP Core Analysis
- A4133 Review CSP Edge & Fastener Analysis

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV			X	DRAFT		PUBLICATION	
	NODE: A3	TITLE:					



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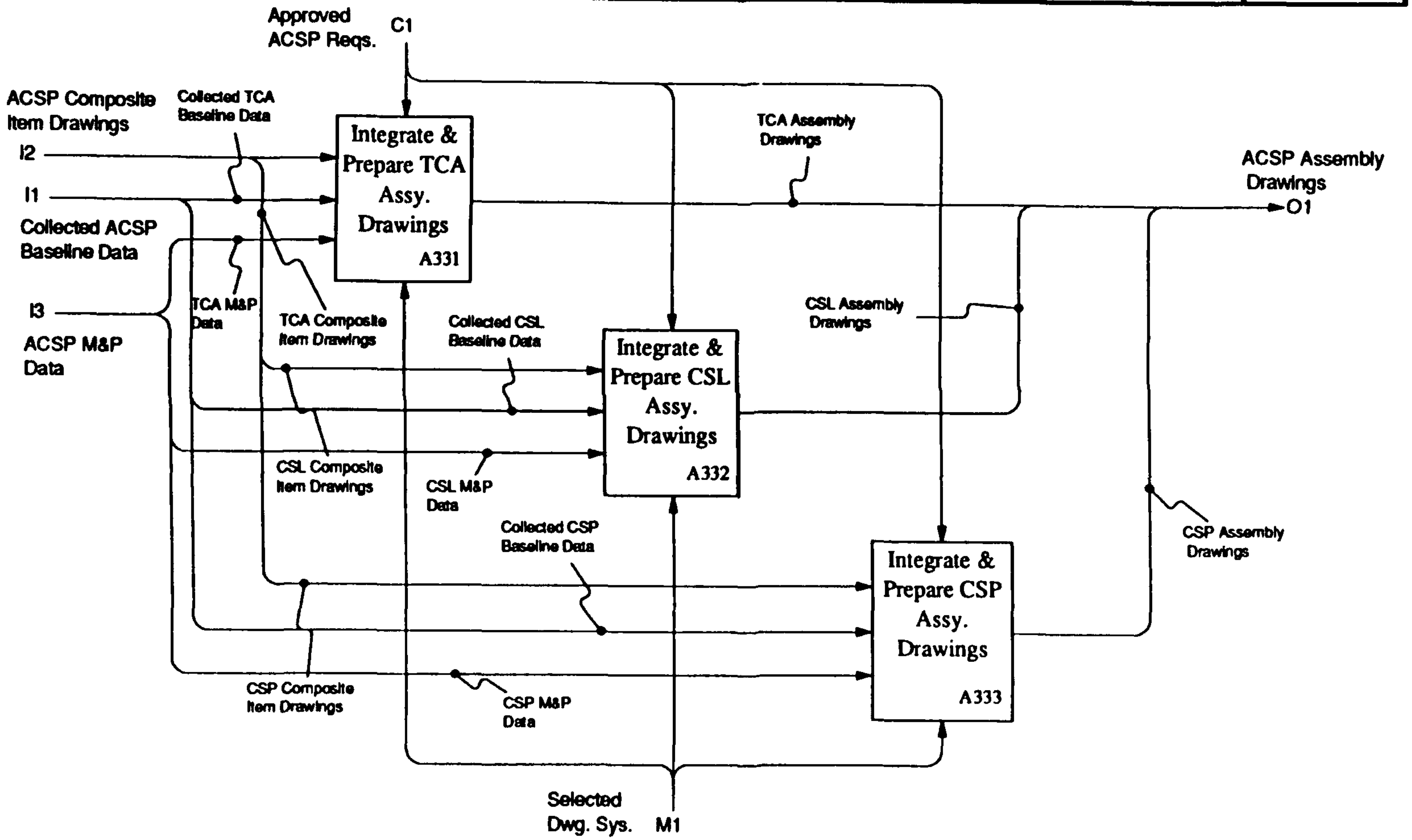
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A33	TITLE: Integrate & Prepare ACSP Assy. Drawings					



A33: Integrate & Prepare ACSP Assy. Drawings

Activities:

A331 **Integrate & Prepare TCA Assy. Drawings**
Collet the TCA composite item details and integrate them into a TCA assembly drawing.

A332 **Integrate & Prepare CSL Assy. Drawings**
Collect the CSL composite details and integrate them into a CSL assembly drawing.

A333 **Integrate & Prepare CSP Assy. Drawings**
Collect the CSP composite item details and integrate them into a CSP assembly drawing.

Inputs:

I1 **Collected ACSP Baseline Data**
This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

- Collected TCA Baseline Data
  This collected baseline drawing data consists of all the drawing data from the selected TCA preliminary design, test data and producibility and maintainability studies.

- Collected CSL Baseline Data
  This collected baseline drawing data consists of all the drawing data from the selected CSL preliminary design, test data and producibility and maintainability studies.

- Collected CSP Baseline Data
  This collected baseline drawing data consists of all the drawing data from the selected CSP preliminary design, test data and producibility and maintainability studies.

I2 ACSP Composite Item Drawings
The ACSP composite item drawings are all the design details of the subcomponents and assembly of the ACSP.

- TCA Composite Item Drawings
  The TCA composite item drawings are all the design details of the subcomponents and assembly of the TCA.

- CSL Composite Item Drawings
  The CSL composite item drawings are all the design details of the subcomponents and assembly of the CSL.

- CSP Composite Item Drawings
  The CSP composite item drawings are all the design details of the subcomponents and assembly of the CSP.

I3 **ACSP M&P Data**
This is all the necessary materials and processes data for the composite materials that make up the ACSP.

- TCA M&P Data
  This is all the necessary materials and processes data for the composite materials that make up the TCA.

- CSL M&P Data
  This is all the necessary materials and processes data for the composite materials that make up the CSL.

- CSP M&P Data
  This is all the necessary materials and processes data for the composite materials that make up the CSP.

Controls:

C1 **Approved ACSP Reqs.**
These are the functional and cross-functional requirements that have been reviewed to be specific to an ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 **ACSP Assembly Drawings**
ACSP Assembly drawings show how the composite component items are positioned in an assembly.

- TCA Assembly Drawings
  TCA Assembly drawings show how the composite component items are positioned in an assembly.

- CSL Assembly Drawings
  CSL Assembly drawings show how the composite component items are positioned in an assembly.

- CSP Assembly Drawings
  CSP Assembly drawings show how the composite component items are positioned in an assembly.

Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

(None)

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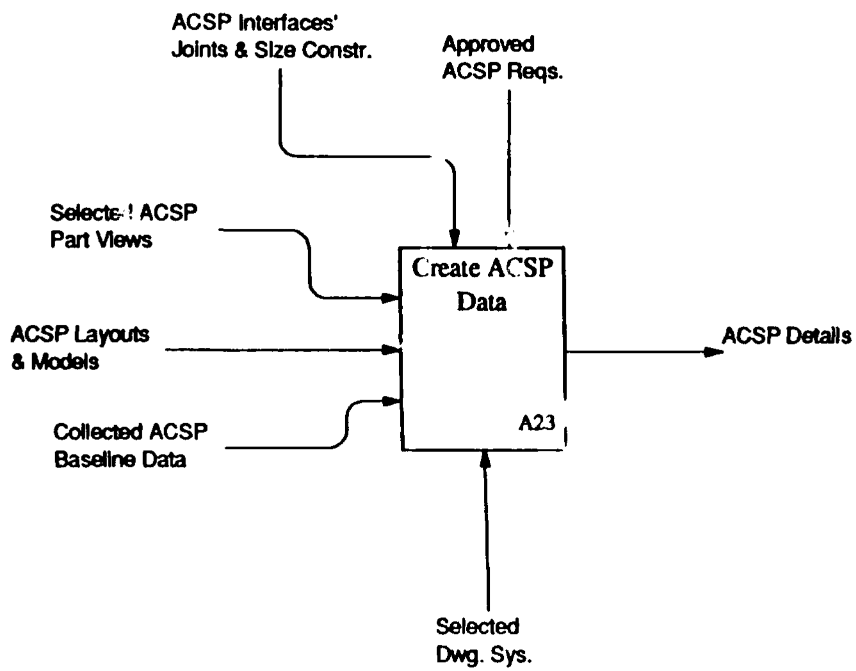
	NODE: A2	TITLE:			



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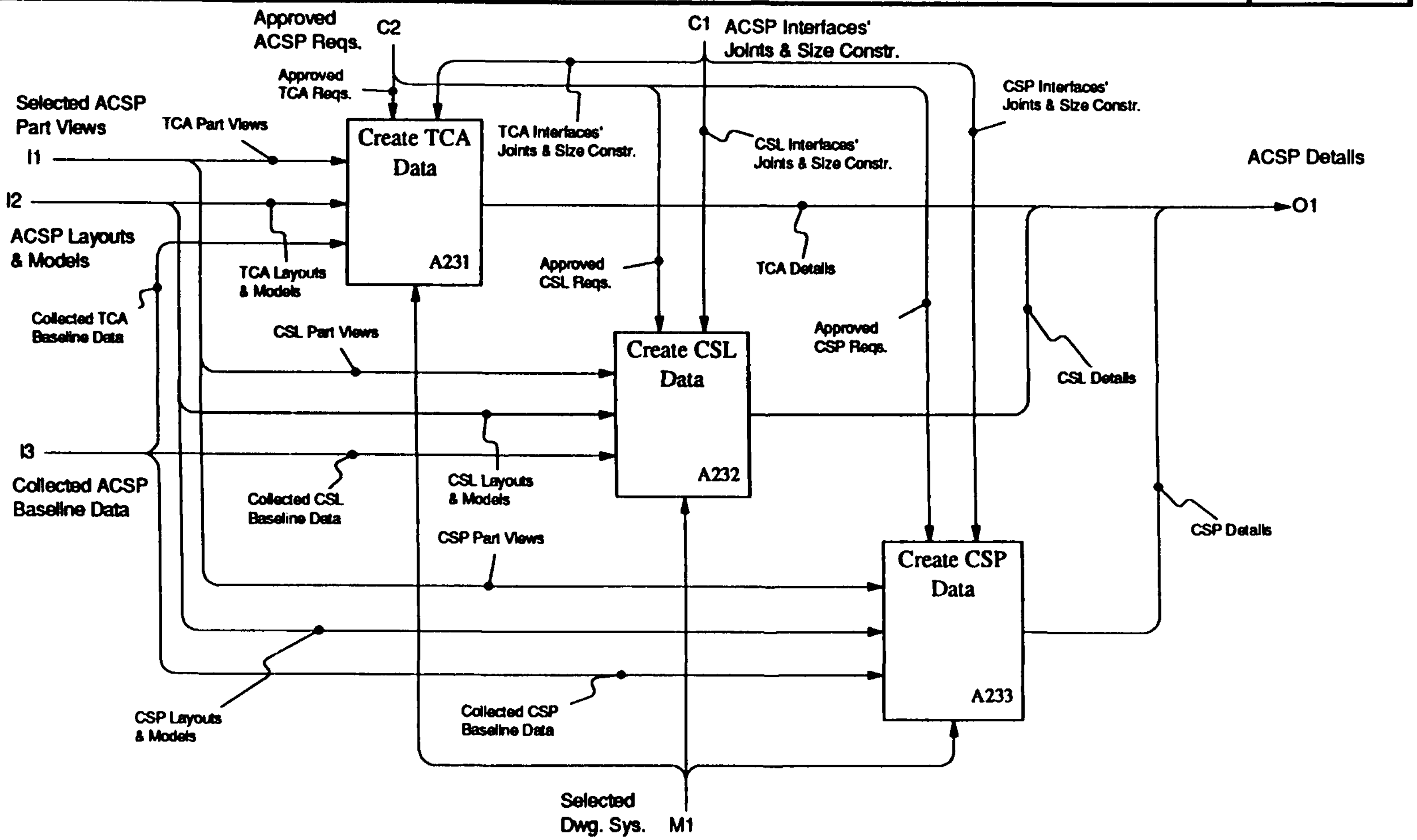
USED AT: **Boeing GD & LTV**	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00		WORKING		RECOMMENDED
			X	DRAFT		PUBLICATION
	NODE: A23	TITLE: Create ACSP Data				CONTEXT:



A23: Create ACSP Data

Activities:

A231 Create TCA Data

This activity consists of the creation of all the TCA design data which includes the cap, angles, and filler geometry, mating interface parameters and manufacturing process constraints.

A232 Create CSL Data

This activity consists of the creation of all the CSL design data which includes the cap, angles, and filler geometry, mating interface parameters and manufacturing process constraints.

A233 Create CSP Data

This activity consists of the creation of all the CSP design data which includes the cap, angles, and filler geometry, mating interface parameters and manufacturing process constraints.

Inputs:

I1 Selected ACSP Part Views

The selected ACSP part views are the top, front, side and cross-section views necessary to show the geometric features.

- The selected TCA part views are the top, front, side and cross-section views necessary to show the geometric features.
- The selected CSL part views are the top, front, side and cross-section views necessary to show the geometric features.
- The selected CSP part views are the top, front, side and cross-section views necessary to show the geometric features.

I2 ACSP Layouts & Models

The ACSP layouts and models consist of all the two dimensional and three dimensional geometry required of the design.

- TCA Layouts & Models
  The TCA layouts and models consist of all the two dimensional and three dimensional geometry of the TCA.
- CSL Layouts & Models
  The CSL layouts and models consist of all the two dimensional and three dimensional geometry of the CSL.
- CSP Layouts & Models
  The CSP layouts and models consist of all the two dimensional and three dimensional geometry of the CSP.

I3 Collected ACSP Baseline Data

This collected baseline drawing data consists of all the drawing data from the selected ACSP preliminary design, test data and producibility and maintainability studies.

- Collected TCA Baseline Data
  This collected baseline drawing data consists of all the drawing data from the selected TCA preliminary design, test data and producibility and maintainability studies.
- Collected CSL Baseline Data
  This collected baseline drawing data consists of all the drawing data from the selected CSL preliminary design, test data and producibility and maintainability studies.
- Collected CSP Baseline Data
  This collected baseline drawing data consists of all the drawing data from the selected CSP preliminary design, test data and producibility and maintainability studies.

Controls:

C1 ACSP Interfaces, Joints, and Size Constraints

The ACSP interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.

- The TCA interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.
- The CSL interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.
- The CSP interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.

C2 Approved ACSP Reqs.

These are the functional and cross-functional requirements that have been reviewed to be specific to a ACSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

- Approved TCA Reqs.
  These are the functional and cross-functional requirements that have been reviewed to be specific to a TCA. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

- Approved CSL Reqs.
  These are the functional and cross-functional requirements that have been reviewed to be specific to a CSL. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

- Approved CSP Reqs.
  These are the functional and cross-functional requirements that have been reviewed to be specific to a CSP. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 ACSP Details

ACSP details consists of all the design data required of the ACSP as a result of mating interfaces and joints, and internal design, and manufacturing considerations. This all takes the form of drawings and parts lists that are distributed to other user functions.

- TCA Details
  TCA details consists of all the design data required of the TCA as a result of mating interfaces and joints, and internal design, and manufacturing considerations. This all takes the form of drawings and parts lists that are distributed to other user functions.

- CSL Details
  CSL details consists of all the design data required of the CSL as a result of mating interfaces and joints, and internal design, and manufacturing considerations. This all takes the form of drawings and parts lists that are distributed to other user functions.

- CSP Details
  CSP details consists of all the design data required of the CSP as a result of mating interfaces and joints, and internal design, and manufacturing considerations. This all takes the form of drawings and parts lists that are distributed to other user functions.

Mechanisms:

M1 Selected Dwg. Sys.

This is the selected drawing system needed to support the detail design development.

Process Interactions:

(None)

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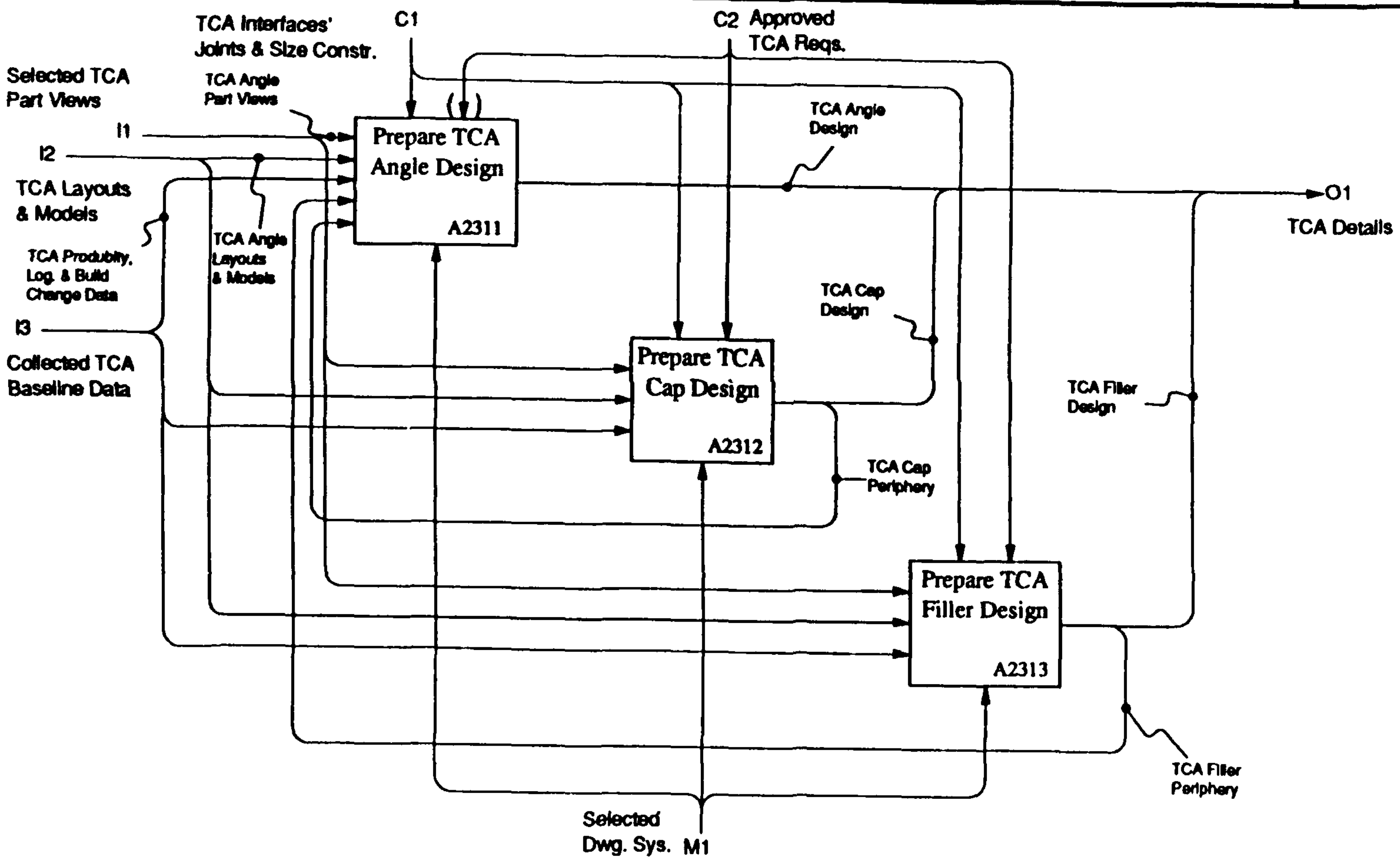
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A231	TITLE: Create TCA Data					



A231: Create TCA Data

Activities:

A2311 **Prepare TCA Angle Design**
Prepare all of the design data necessary for the angles of the TCA. This involves tailoring the laminate design process to meet the geometric constraints and interfaces, internal and external to the TCA.

A2312 **Prepare TCA Cap Design**
Prepare all of the design data necessary for the cap of the TCA. This involves tailoring the laminate design process to meet the geometric constraints and interfaces, internal and external to the TCA.

A2313 **Prepare TCA Filler Design**
Prepare all of the design data necessary for the filler of the TCA. This is primarily based on the envelope, material features and the producibility and inspectability of the filler when assembled.

Inputs:

I1 **Selected TCA Part Views**
The selected TCA part views are the top, front, side and cross-section views necessary to show the geometric features.

- TCA Angle Part Views
  The TCA angle part views are the various selected views necessary to show the desired features. These include the typical front, top and side views.

I2 **TCA Layouts & Models**
The TCA layouts and models consist of all the two dimensional and three dimensional geometry required of the design.

- TCA Angle Layouts & Models
  The TCA angle layouts and models consist of all the two dimensional and three dimensional geometry of the TCA.

I3 **Collected TCA Baseline Data**
This collected baseline drawing data consists of all the drawing data from the selected TCA preliminary design, test data and producibility and maintainability studies necessary for the filler design.

- TCA Producibility Log. & Build Change Data
  This is the TCA's producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

Controls:

C1 **TCA Interfaces, Joints, and Size Constraints**
The TCA interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.

C2 **Approved TCA Reqs.**
These are the functional and cross-functional requirements that have been reviewed to be specific to a TCA. The include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 **TCA Details**
TCA details consists of the design data required for the angle, cap and filler.

- TCA Angle Design
  The TCA angle design consists of all the geometry and associated laminate information necessary to produce the angles and install them in a TCA.
- TCA Cap Design
  The TCA cap design consists of all the geometry and associated laminate information necessary to produce the caps and install them in a TCA.
- TCA Filler Design
  The TCA filler design is based on the envelope and material features that are necessary for the filler within the TCA.

Mechanisms:

M1 **Selected Dwg. Sys.**
This is the selected drawing system needed to support the detail design development.

Process Interactions:

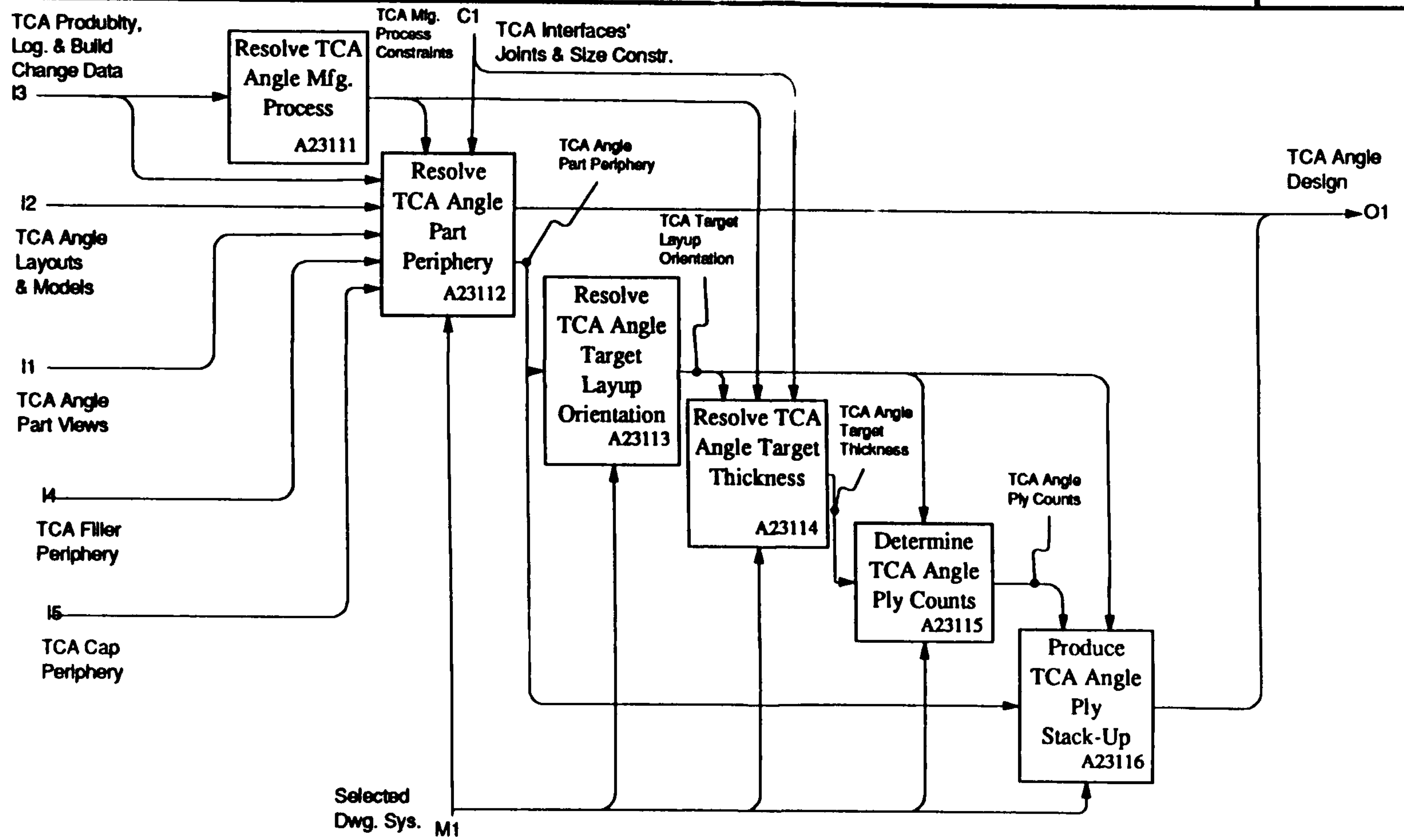
- TCA Cap Design
  The TCA cap design consists of all the geometry and associated laminate information necessary to produce the caps and install them in a TCA.

- TCA Filler Design
  The TCA filler design is based on the envelope and material features that are necessary for the filler within the TCA.

- TCA Cap Periphery
  The TCA cap periphery is the geometry envelope of the cap due to tooling, mating part interfaces and edge parameters.

- TCA Filler Periphery
  The TCA filler periphery is the geometry envelope of the filler as needed to meet the tooling, inspectability and strength features, if desired.

USED AT:	AUTHOR: PAS-C Team & Experts	DATE: 12/5/91		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A2311	TITLE: Prepare TCA Angle Design					



222

A2311: Prepare TCA Angle Design

Activities:

A23111 **Resolve TCA Angle Mfg. Process**
Resolve the TCA angle manufacturing issues which involve the layout, tooling and inspection issues.

A23112 **Resolve TCA Angle Part Periphery**
Resolve the TCA angle part periphery due to tailoring, part interfaces and skin edge parameters.

A23113 **Resolve TCA Angle Target Layup Orientation**
Resolve the TCA target layup orientation of the plies based on the design rules established for %°, 45°, 90° plies in the subject area.

A23114 **Resolve TCA Angle Target Thickness**
Resolve the TCA target thickness based on interfaces to other parts, tooling constraints and strength considerations.

A23115 **Determine TCA Angle Ply Counts**
Determine the TCA angle ply counts based on the guidelines established due to the target lay-up orientations and target thickness.

A23116 **Produce TCA Angle Ply Stack-Up**
Produce the TCA ply stack-up which shows the ply sequence, ply tables and the specific ply periphery details.

Inputs:

I1 **TCA Angle Part Views**
The TCA angle part views are the various selected views necessary to show the desired features. These include the typical front, top and side views.

I2 **TCA Angle Layouts & Models**
The TCA angle layouts and models consist of all the two dimensional and three dimensional geometry required of the TCA.

I3 **TCA Producibility Log. & Build Change Data**
This is the TCA's producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

I4 **TCA Core Periphery**
The TCA core periphery is the edge and internal envelope as constrained by the structural or nonstructural interfaces.

Controls:

C1 **TCA Interfaces, Joints, and Size Constraints**
The TCA interfaces, joints and size constraints are from the various mating parts envelope and joint configuration. The overall panel size is dictated by the area it supports in the next higher assembly.

Outputs:

O1 **TCA Angle Part Details**
These are the angle part details of the TCA as designed to meet the design requirements. This includes the angle part periphery, thickness lay-up orientation and ply stack-up.

Mechanisms:

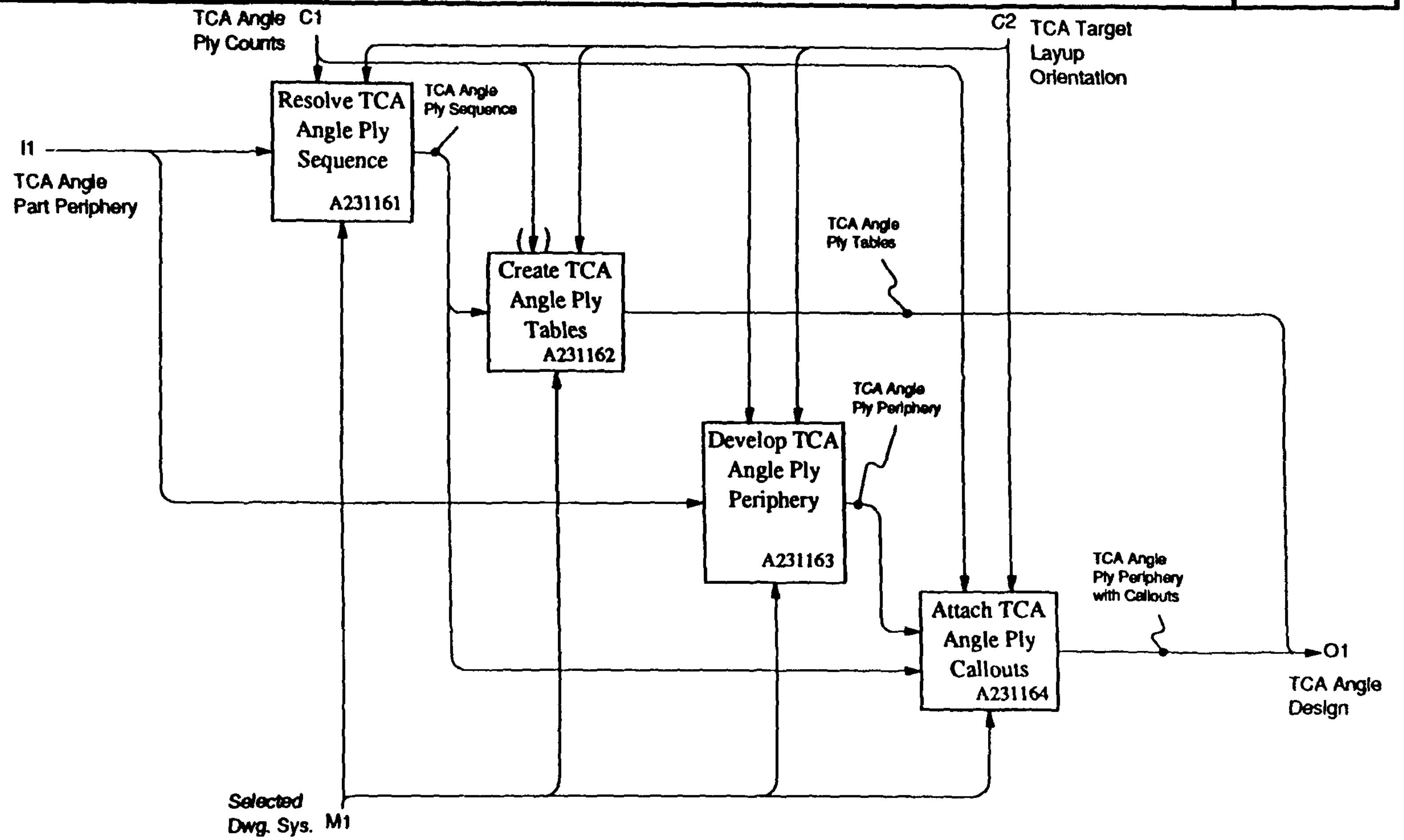
M1 **Selected Dwg. Sys.**
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- **TCA Mfg. Process Constraints**
  These are the specific TCA design constraint as a result of manufacturing issues which involve the lay-up, tooling and inspection issues.
- **TCA Target Lay-Up Orientation**
  The TCA target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.
- **TCA Target Thickness**
  The TCA target thickness is based on interfaces to other parts, tooling constraints and strength considerations.
- **TCA Ply Counts**
  The TCA ply counts are based on the target lay-up orientations and target thickness.

- TCA Angle Part Periphery
  This is the TCA angle part periphery as dictated by tooling and mating part constraints.

USED AT:	AUTHOR: PAS-C Team & Experts	DATE: 12/5/91		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A23116	TITLE: Produce TCA Angle Ply Stack-Up					



A23116: Produce TCA Angle Ply Stack-Up

Activities:

A231161 Resolve TCA Angle Ply Sequence

Resolve the TCA angle ply sequence by showing the laminate layer in the order of build-up from an IML or OML tool.

A231162 Create TCA Angle Ply Tables

Create the TCA angle ply tables based on the sequence input and other pertinent design information.

A231163 Develop TCA Angle Ply Periphery

Develop the TCA angle ply periphery based on tooling constraints in the basic areas, and at the edges, and the geometrical interfaced to other mating parts.

A231164 Attach TCA Angle Ply Callouts

Attach the TCA angle ply callouts to each ply in the TCA laminate by assigning a part number to each of the plies.

Inputs:

I1 TCA Angle Part Periphery

This is the TCA angle part periphery based on tooling constraints in the basic areas, and at the edges, and the geometrical interfaces to other mating parts.

Controls:

C1 TCA Angle Ply Counts

The TCA ply counts are the desired ply counts based on the target lay-up orientations and the target thickness.

C2 TCA Target Lay-Up Orientation

The TCA target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.

Outputs:

O1 TCA Angle Part Details

The TCA angle part details consist of part periphery with callouts and ply table.

- TCA Angle Part Periphery with Callouts
  This is the TCA angle part periphery as dictated by tooling and mating part constraints with unique identifying ply numbers.

- TCA Angle Ply Table
  This TCA angle ply table is the combination of the laminates part and ply numbers, material, fiber orientations, splices and changes.

Mechanisms:

M1 Selected Dwg. Sys.

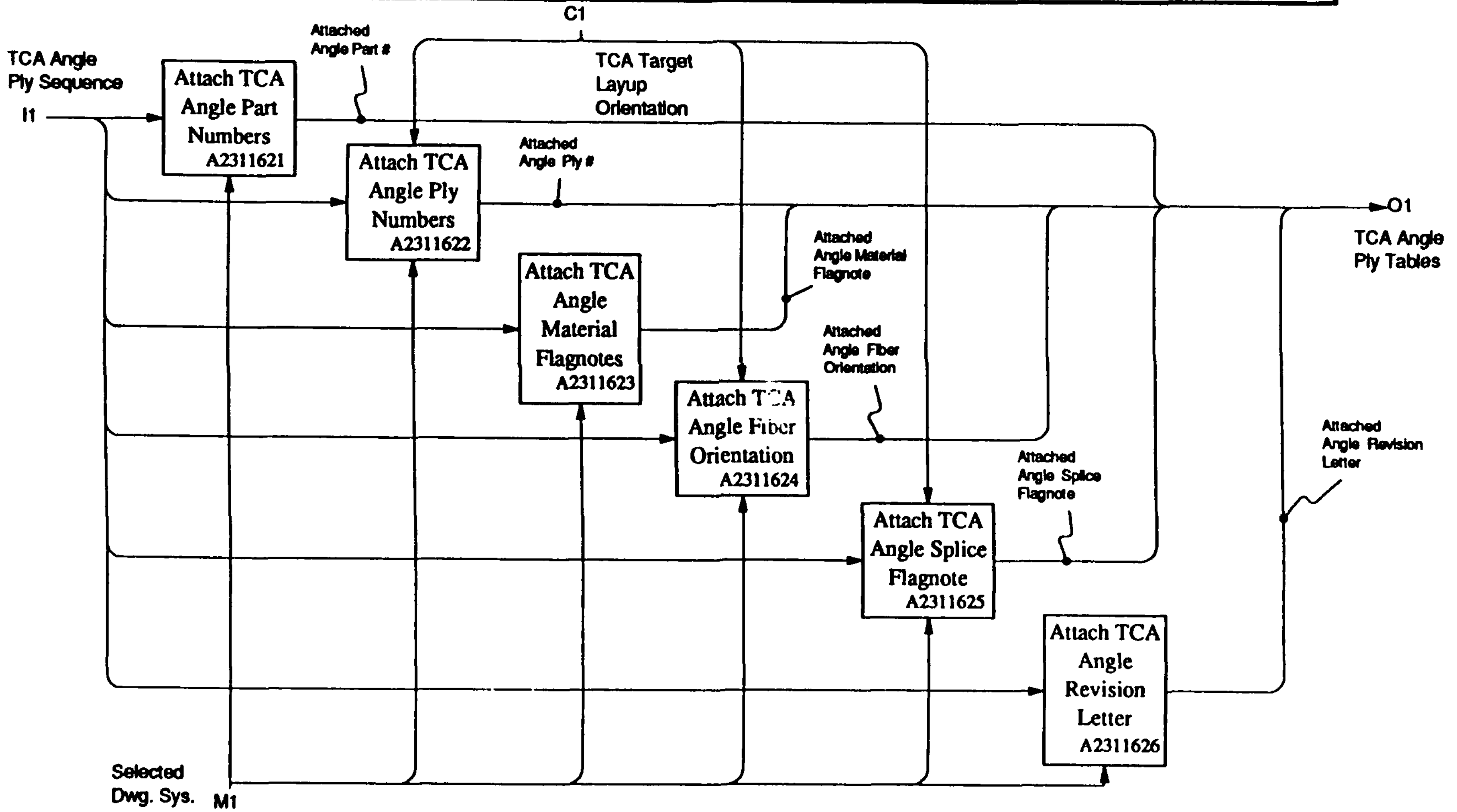
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- TCA Angle Ply Sequence
  This is the designed angle ply sequence of the TCA which shows the ply sequence in the laminate layer in the order of build-up from an IML or OML tool.

- TCA Angle Ply Periphery
  This is the TCA angle ply periphery as dictated by tooling and mating part constraints.

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV	NODE: A231162	TITLE: Create TCA Angle Ply Tables	X	DRAFT		PUBLICATION	



A231162: Create TCA Angle Tables

Activities:

A2311621 Attach TCA Angle Part Numbers
Attach the assigned TCA angle part number to the TCA angle ply table.

A2311622 Attach TCA Angle Ply Numbers
Attach the assigned TCA angle ply number to the TCA angle ply table.

A2311623 Attach TCA Angle Material Flagnotes
Attach the various TCA angle material flagnotes to the TCA angle ply table.

A2311624 Attach TCA Angle Fiber Orientation
Attach the angle fiber orientation to the TCA angle ply table.

A2311625 Attach TCA Angle Splice Flagnote
Attach the angle splice flagnotes to the TCA angle ply table.

A2311626 Attach TCA Angle Revision Letter
Attach the appropriate revision letter, of the change status, to the TCA angle ply table.

Inputs:

I1 TCA Angle Ply Sequence
This is the designed angle ply sequence of the TCA which shows the ply sequence in the laminate layer in the order of build-up from an IML or OML tool.

Controls:

C1 TCA Target Lay-Up Orientation
The TCA target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.

Outputs:

O1 TCA Angle Ply Table
This TCA angle ply table is the combination of the laminates part and ply numbers, material, fiber orientations, splices and changes.

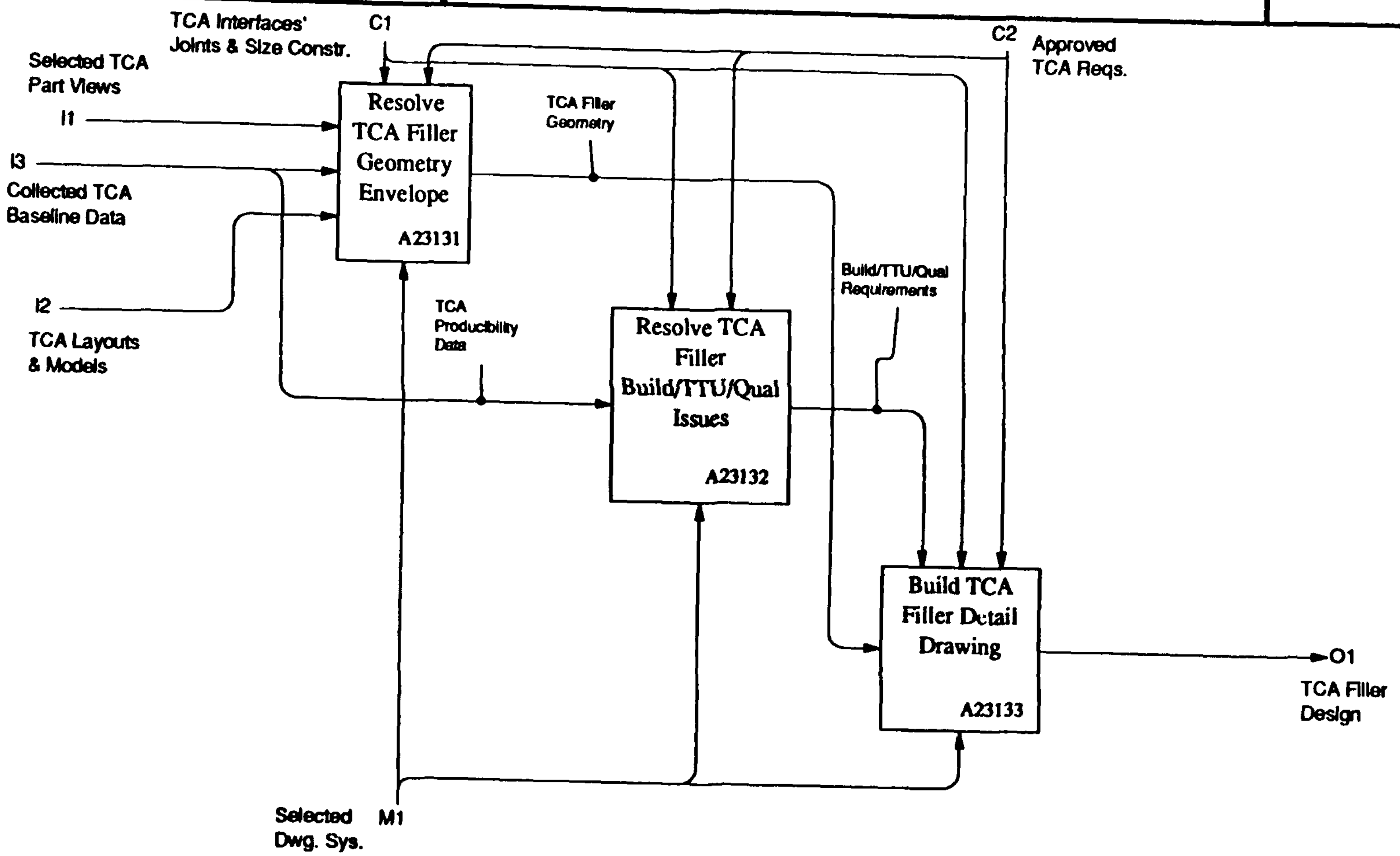
Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- Attached Angle Part & Ply Number
- Attached Angle Part & Ply Number & Material Flagnotes
- Attached Angle Part & Ply Number & Material Flagnotes & Fiber Orientation
- Attached Angle Part & Ply Number & Material Flagnotes & Fiber Orientation & Splice Flagnote

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A2313	TITLE: Prepare TCA Filler Design			



230

A2313: Prepare TCA Filler Design

Activities:

A23131 Resolve TCA Filler Geometry Envelope

Resolve the TCA filler geometry envelope to meet the envelope constraints of the angles and cap in the transverse and longitudinal directions.

A23132 Resolve TCA Filler Build/TTU/Quality Issues

Resolve all of the TCA filler producibility and its rough transmission inspectability within the assembly.

A23133 Build TCA Filler Detail Drawing

Build the detail drawings for the TCA filler.

Inputs:

I1 Collect TCA Baseline Data

This collected TCA baseline data consists of the selected preliminary TCA design, test data and producibility and maintainability studies necessary for the filler design.

I2 Selected TCA Part Views

The selected TCA part views are the top, front and side views necessary to show the TCA details of the filler.

I3 TCA Layouts & Models

The TCA layouts and models are all the two dimensional and three dimensional geometry of the TCA.

I4 TCA Producibility Data

This is all the producibility data generated for the TCA based on existing manufacturing resources and tolerances.

Controls:

C1 TCA Interfaces, Joints & Size Constraints

The TCA interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.

C2 Approved TCA Reqs.

These are the functional and cross-functional requirements that have been reviewed to be specific to the TCA. These include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 TCA Filler Design

The TCA filler design is based on the envelope and material features that are necessary for the filler within the TCA.

Mechanisms:

M1 Selected Dwg. Sys.

This is the selected drawing system needed to support the detail design development.

Process Interactions:

- TCA Filler Geometry

  The TCA filler geometry is the envelope necessary to meet the overall TCA design requirements.

- Build/TTU/Quality Requirements

  The build/TTU/quality requirements are the producibility and inspectability parameters necessary for the filler design.

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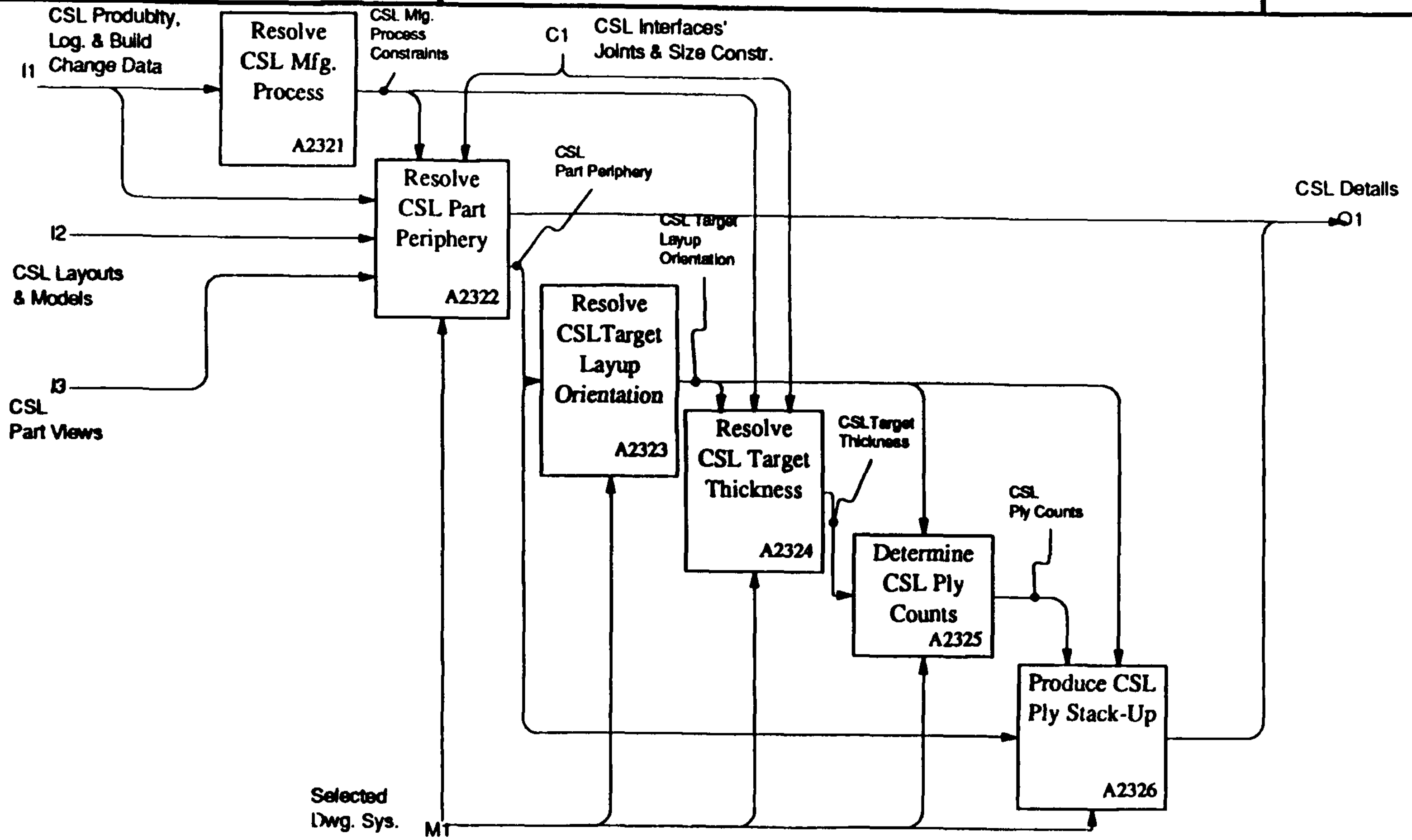
	NODE: A232	TITLE: Create CSL Data			



232

A232: Create CSL Details

Activities:

A2321 **Resolve CSL Mfg. Process**
Resolve the CSL angle manufacturing issues which involve the layout, tooling and inspection issues.

A2322 **Resolve CSL Part Periphery**
Resolve the CSL part periphery due to tailoring, part interfaces and skin edge parameters.

A2323 **Resolve CSL Target Lay-up Orientation**
Resolve the CSL target lay-up orientation of the plies based on the design rules established for 0°, 45°, 90° plies in the subject area.

A2324 **Resolve CSL Target Thickness**
Resolve the CSL target thickness based on interfaces to other parts, tooling constraints and strength considerations.

A2325 **Determine CSL Ply Counts**
Determine the CSL ply counts based on the guidelines established due to the target lay-up orientations and target thickness.

A2326 **Produce CSL Ply Stack-Up**
Produce the CSL ply stack-up which shows the ply sequence, ply tables and the specific ply periphery details.

Inputs:

I1 **CSL Part Views**
The CSL part views are the various selected views necessary to show the desired features. These include the typical front, top and side views.

I2 **CSL Layouts & Models**
The CSL layouts and models consist of all the two dimensional and three dimensional *geometry required of the CSL*.

I3 **CSL Producibility Log. & Build Change Data**
This is the CSL's producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

I4 **CSL Core Periphery**
The CSL core periphery is the edge and internal envelope as constrai[illegible] by the structural or nonstructural interfaces.

Controls:

C1 **CSL Interfaces, Joints, and Size Constraints**
The CSL interfaces, joints and size constraints are from the various mating parts envelope and joint configuration. The overall panel size is dictated by the area it supports in the next higher assembly.

Outputs:

O1 **CSL Part Details**
These are the part details of the CSL as designed to meet the design requirements. This includes the part periphery, thickness lay-up orientation and ply stack-up.

Mechanisms:

M1 ***Selected Dwg. Sys.***
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- **CSL Mfg. Process Constraints**
  These are the specific CSL design constraint as a result of manufacturing issues which involve the lay-up, tooling and inspection issues.

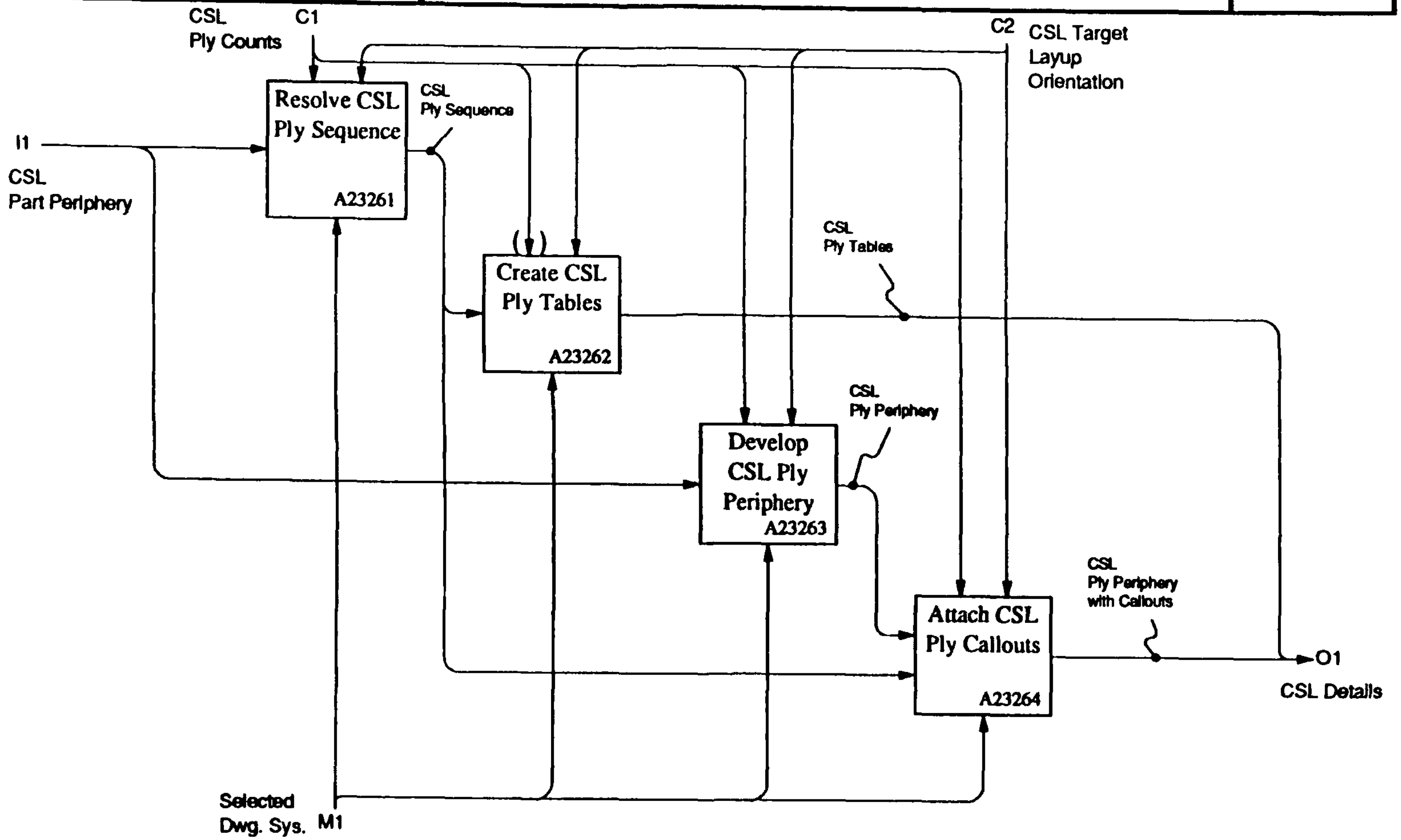
- **CSL Target Lay-Up Orientation**
  The CSL target lay-up orientation is based on the laminate design rules for 0°, 45°, 90° orientation in the subject area.

- **CSL Target Thickness**
  The CSL target thickness is based on interfaces to other parts, tooling constraints and strength considerations.

- **CSL Ply Counts**
  The CSL ply counts are based on the target lay-up orientations and target thickness.

- CSL Part Periphery
  This is the CSL part periphery as dictated by tooling and mating part constraints.

USED AT: **Boeing GD & LTV**	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	[ ] WORKING [X] DRAFT	[ ] RECOMMENDED [ ] PUBLICATION
	NODE: A2326	TITLE: Produce CSL Ply Stack-Up		CONTEXT:



A2326: Produce CSL PLY Stack-Up

Activities:

A23261 Resolve CSL Ply Sequence
Resolve the CSL ply sequence by showing the laminate layer in the order of build-up from an IML or OML tool.

A23262 Create CSL Ply Tables
Create the CSL ply tables based on the sequence input and other pertinent design information.

A23263 Develop CSL Ply Periphery
Develop the CSL ply periphery based on tooling constraints in the basic areas, and at the edges, and the geometrical interfaced to other mating parts.

A23264 Attach CSL Ply Callouts
Attach the CSL ply callouts to each ply in the CSL laminate by assigning a part number to each of the plies.

Inputs:

I1 CSL Part Periphery
This is the CSL angle part periphery based on tooling constraints in the basic areas, and at the edges, and the geometrical interfaces to other mating parts.

Controls:

C1 CSL Ply Counts
The CSL ply counts are the desired ply counts based on the target lay-up orientations and the target thickness.

C2 CSL Target Lay-Up Orientation
The CSL target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.

Outputs:

O1 CSL Part Details
The CSL part details consist of part periphery with callouts and ply table.

- CSL Part Periphery with Callouts
  This is the CSL part periphery as dictated by tooling and mating part constraints with unique identifying ply numbers.

- CSL Ply Table
  This CSL ply table is the combination of the laminates part and ply number , material, fiber orientations, splices and changes.

Mechanisms:

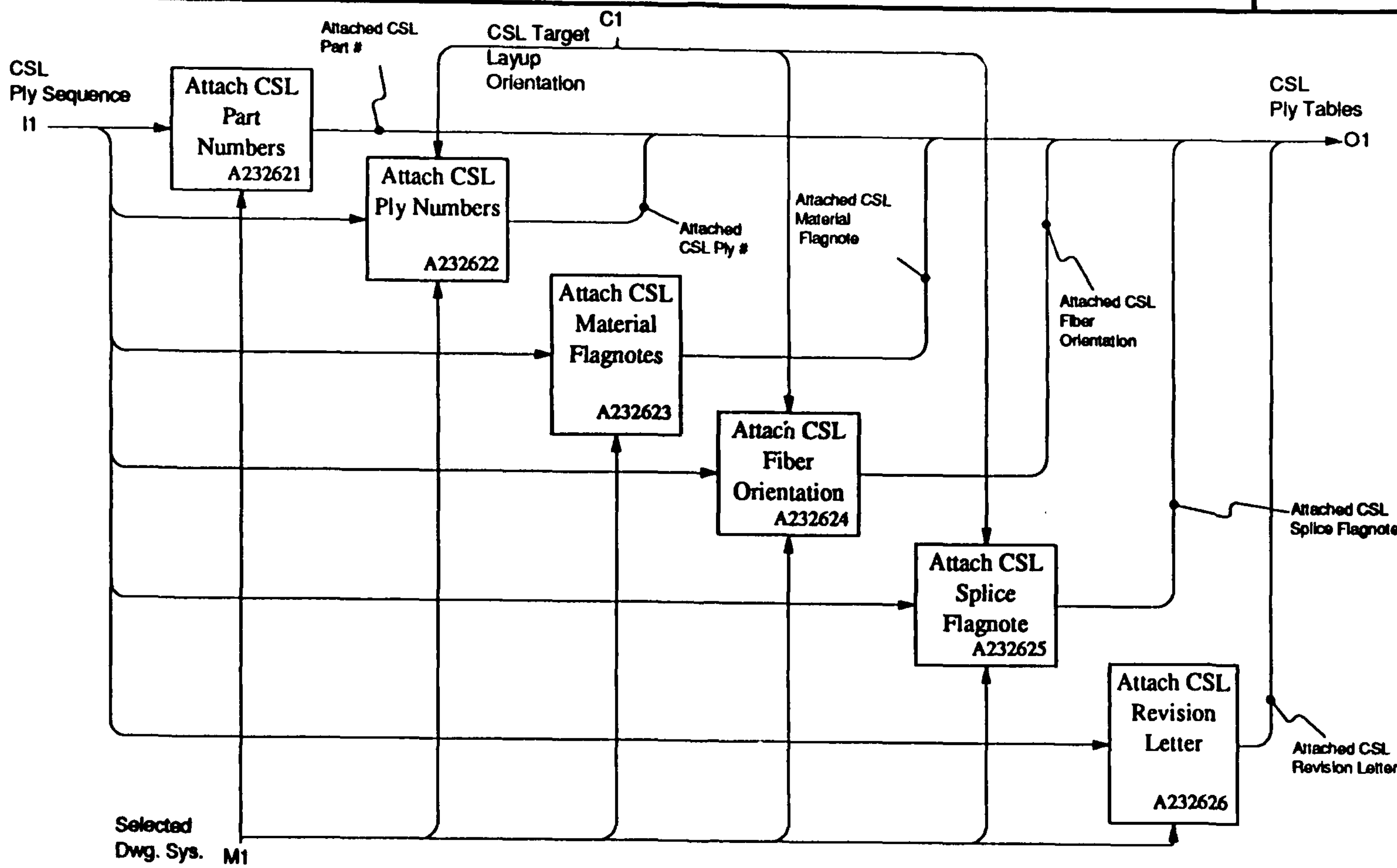
M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSL Ply Sequence
  This is the designed ply sequence of the CSL which shows the ply sequence in the laminate layer in the order of build-up from an IML or OML tool.

- *CSL Ply Periphery*
  This is the CSL ply periphery as dictated by tooling and mating part constraints.

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV			X	DRAFT		PUBLICATION	
	NODE: A23262	TITLE: Create CSL Ply Tables					



A23262: Create CSL Tables

Activities:

A232621 Attach CSL Part Numbers
Attach the assigned CSL part number to the CSL ply table.

A232622 Attach CSL Ply Numbers
Attach the assigned CSL ply number to the CSL ply table.

A232623 Attach CSL Material Flagnotes
Attach the various CSL material flagnotes to the CSL ply table.

A232624 Attach CSL Fiber Orientation
Attach the angle fiber orientation to the CSL ply table.

A232625 Attach CSL Splice Flagnote
Attach the angle splice flagnotes to the CSL ply table.

A232626 Attach CSL Revision Letter
Attach the appropriate revision letter, of the change status, to the CSL ply table.

Inputs:

I1 CSL Ply Sequence
This is the designed ply sequence of the CSL which shows the ply sequence in the laminate layer in the order of build-up from an IML or OML tool.

Controls:

C1 CSL Target Lay-Up Orientation
The CSL target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.

Outputs:

O1 TCA Angle Ply Table
This TCA angle ply table is the combination of the laminates part and ply numbers, material, fiber orientations, splices and changes.

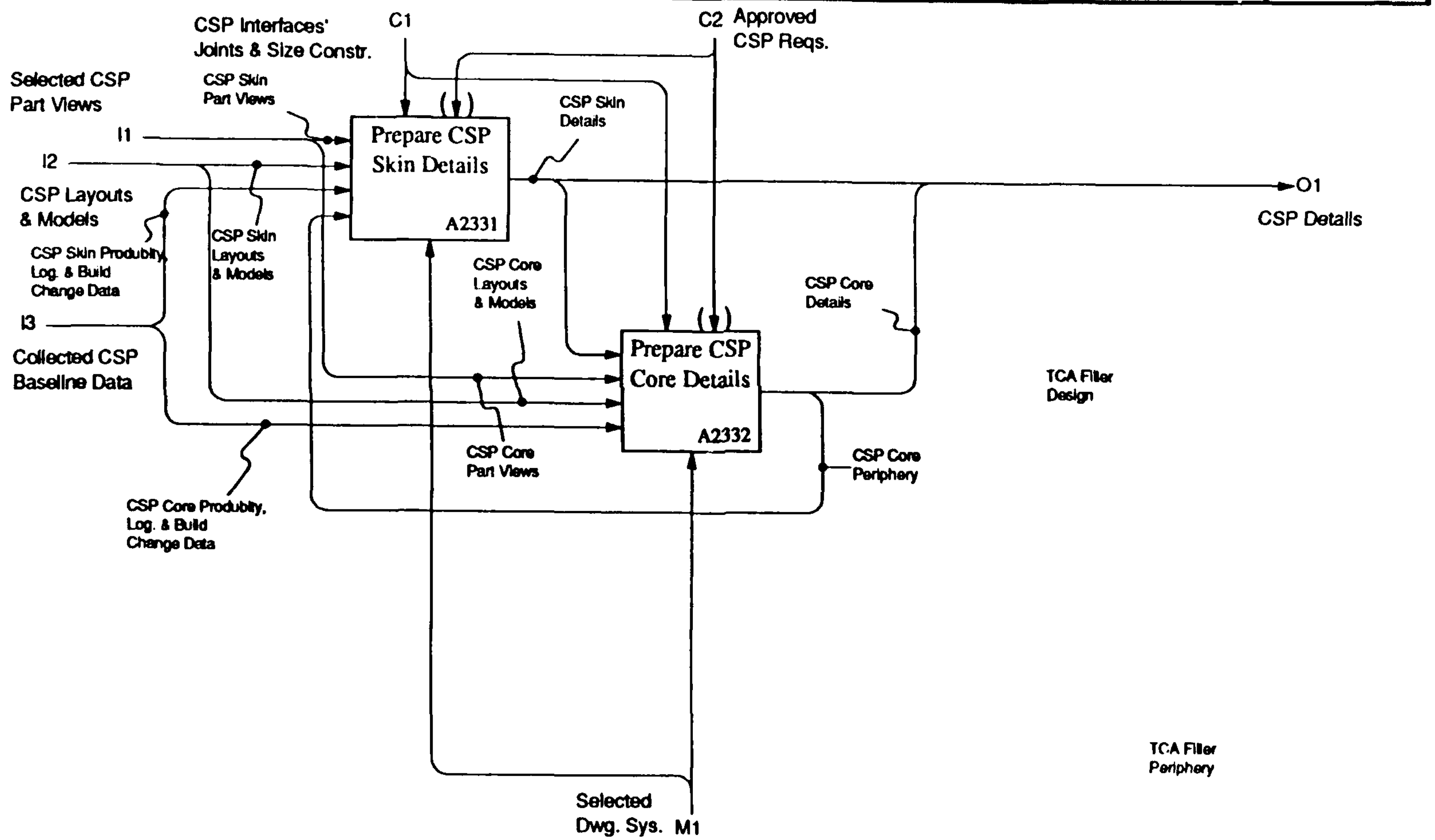
Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- Attached CSL Part & Ply Number
- Attached CSL Part & Ply Number & Material Flagnotes
- Attached CSL Part & Ply Number & Material Flagnotes & Fiber Orientation
- Attached CSL Part & Ply Number & Material Flagnotes & Fiber Orientation & Splice Flagnote

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	WORKING	RECOMMENDED	CONTEXT:
Boeing GD & LTV	NODE: A233	TITLE: Create CSP Data	X DRAFT	PUBLICATION	



270

A233: Create CSP Data

Activities:

A2331 Prepare CSP Skin Details
This is the preparation of all the CSP skin details to resolve the skin periphery, thickness, layup orientation and ply stack-up.

A2332 Prepare CSP Core Details
This is the preparation of all the CSP core details to resolve the core periphery, thickness, density, material, transition and ribbon features.

Inputs:

I1 Selected CSP Part Views
The selected CSP part views consist of the respective top, front, and side views of the skin and core areas of the CSP.

- CSP Skin Part Views
  The CSP skin part views are the various selected views necessary to show the desired features. *These include the typical front, top and side views.*

I2 CSP Layouts & Models
The CSP Layouts and models are all the two dimensional and three dimensional geometry of the CSP skin and core.

- CSP Skin Layouts & Models
  The CSP skin layouts and models are all the two dimensional and three dimensional geometry of the skin.

- CSP Core Layouts & Models
  The CSP core layouts and models are all the two dimensional and three dimensional geometry of the core.

I3 Collected CSP Baseline Data
This collected CSP baseline data consists of the selected preliminary CSP design, test data and producibility and maintainability.

- CSP Producibility Log. & Build Change Data
  This is the CSP's producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

Controls:

C1 CSP Interfaces, Joints & Size Constraints
The CSP interfaces, joints and size constraints are from the various mating parts envelope and joint configuration along with the overall panel size constraints.

C2 Approved CSP Reqs.
These are the functional and cross-functional requirements that have been reviewed to be specific to the CSP. These include the technical performance constraints of the various functions along with the envelope features that are desired. The pertinent functions are from the Manage, Design, Build and Support activities.

Outputs:

O1 CSP Details
CSP details consist of all the design data for the CSP skin and core.

- CSP Skin Details
  These are the details of the CSP skin as designed to meet the design requirements. This includes the skin periphery, thickness, lay-up orientation and ply stack-up.

- CSP Core Details
  The CSP core details consist of the core periphery, thickness, density, internal, transition and ribbon features.

Mechanisms:

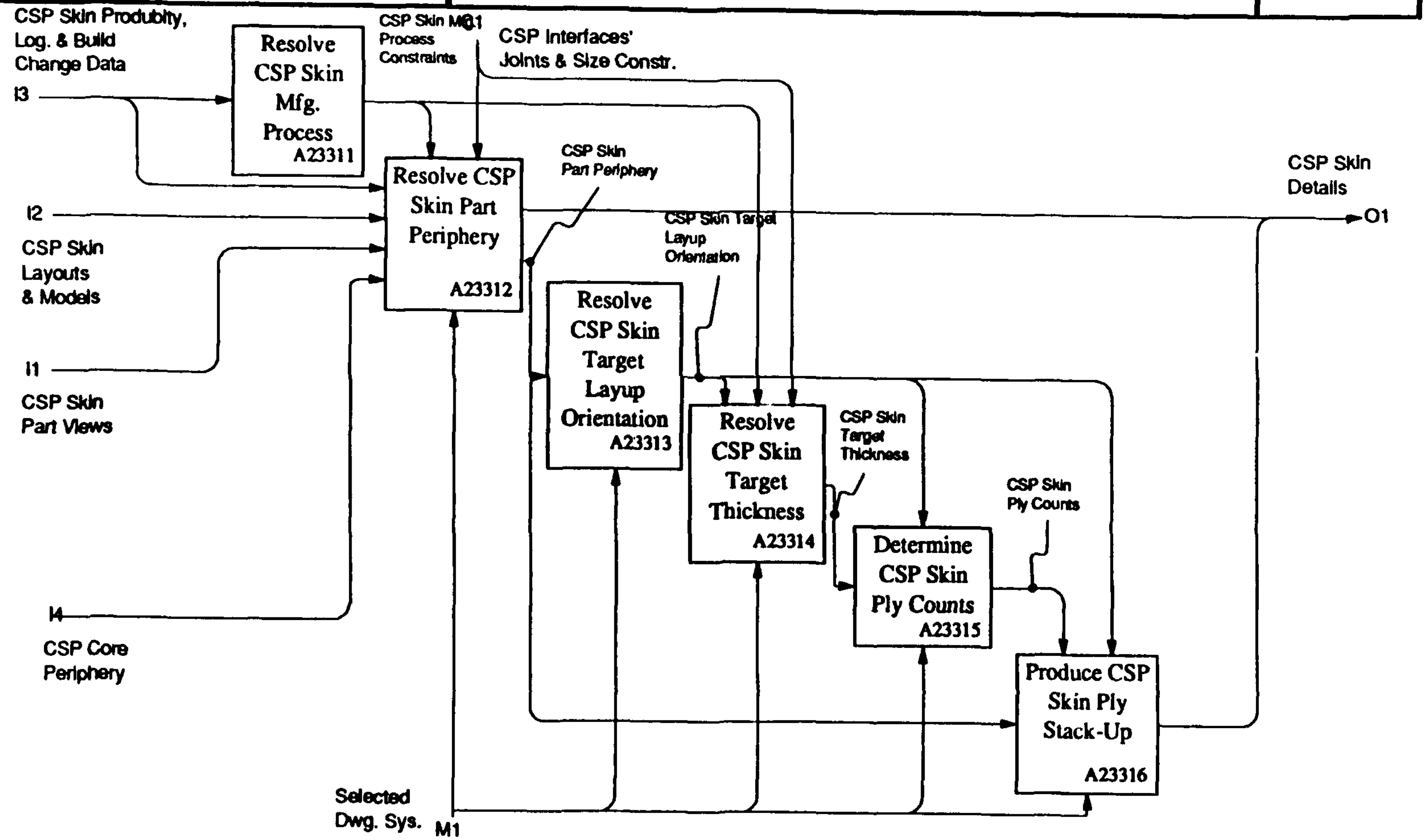
M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSP Skin Details
  These are the details of the CSP skin as designed to meet the design requirements. This includes the skin periphery, thickness, lay-up orientation and ply stack-up.

- CSP Core Details
  The CSP core details consist of the core periphery, thickness, density, internal, transition and ribbon features.

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	☐ WORKING X DRAFT	☐ RECOMMENDED ☐ PUBLICATION	CONTEXT:
	NODE: A2331	TITLE: Prepare CSP Skin Details			



A2331: Prepare CSP Skin Details

Activities:

A23311 Resolve CSP Skin Mfg. Process
Resolve the CSP skin manufacturing issues which involve the layout, tooling and inspection issues.

A23312 Resolve CSP Skin Part Periphery
Resolve the CSP skin part periphery due to tailoring, part interfaces and skin edge parameters.

A23313 Resolve CSP Skin Target Layup Orientation
Resolve the CSP target layup orientation of the plies based on the design rules established for %°, 45°, 90° plies in the subject area.

A23314 Resolve CSP Skin Target Thickness
Resolve the CSP target thickness based on interfaces to other parts, tooling constraints and strength considerations.

A23315 Determine CSP Skin Ply Counts
Determine the Skin ply counts based on the guidelines established due to the target lay-up orientations and target thickness.

A23316 Produce CSP Skin Ply Stack-Up
Produce the CSP skin ply stack-up which shows the ply sequence, ply tables and the specific ply periphery details.

Inputs:

I1 CSP Skin Part Views
The CSP skin part views are the various selected views necessary to show the desired features. These include the typical front, top and side views.

I2 CSP Skin Layouts & Models
The CSP skin layouts and models consist of all the two dimensional and three dimensional geometry required of the CSP.

I3 CSP Producibility Log. & Build Change Data
This is the CSP's producibility data as developed, based on manufacturing requirements. *This is the logistics data that includes reliability and maintainability studies.* Build change data are changes necessary to support the production problems.

I4 CSP Core Periphery
The CSP core periphery is the edge and internal envelope as constrained by the structural or nonstructural interfaces.

Controls:

C1 CSP Interfaces, Joints, and Size Constraints
The CSP interfaces, joints and size constraints are from the various mating parts envelope and joint configuration. The overall panel size is dictated by the area it supports in the next higher assembly.

Outputs:

O1 CSP Skin Details
These are the skin details of the CSP as designed to meet the design requirements. This includes the angle part periphery, thickness lay-up orientation and ply stack-up.

Mechanisms:

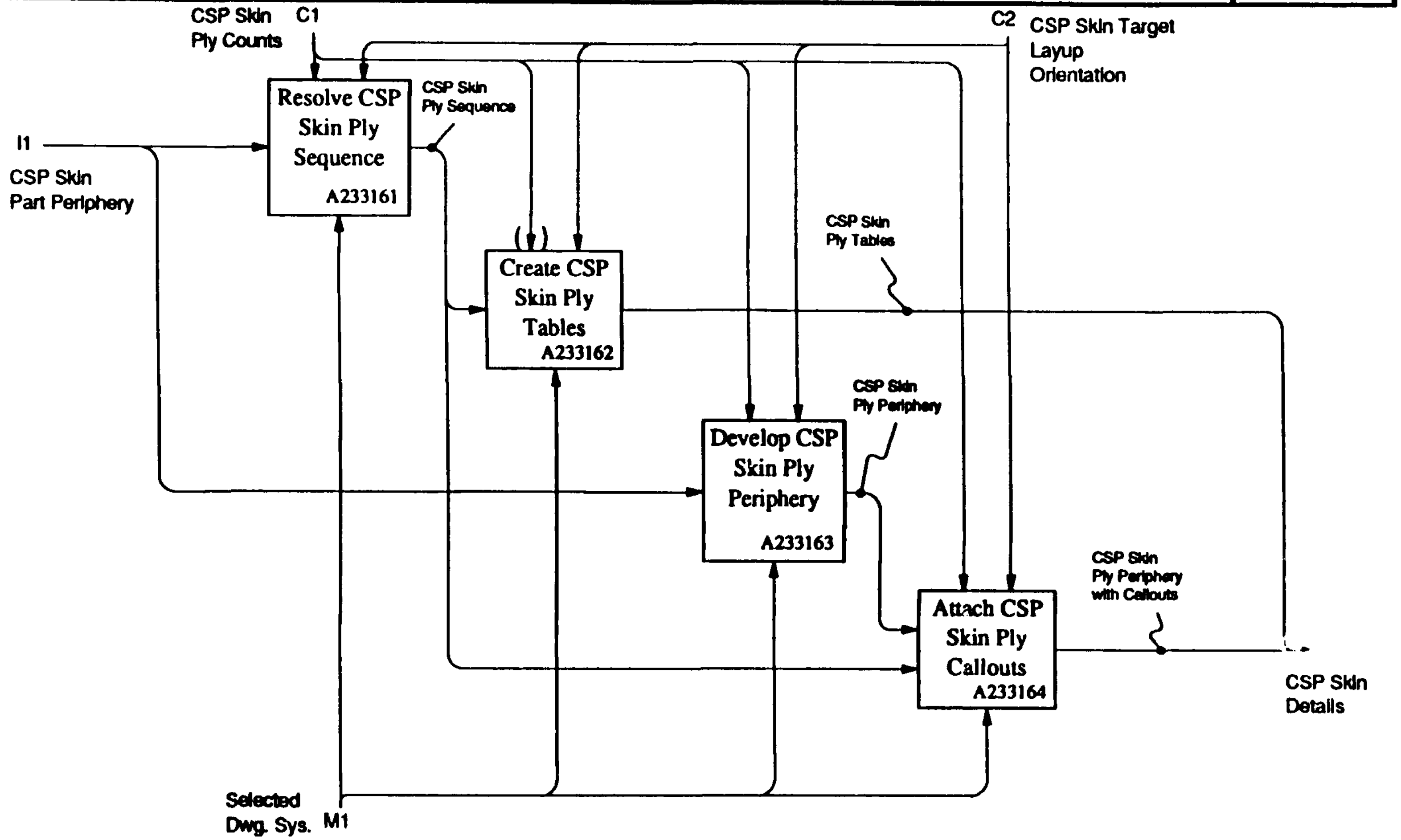
M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSP Mfg. Process Constraints
  These are the specific CSP design constraint as a result of manufacturing issues which involve the lay-up, tooling and inspection issues.
- CSP Target Lay-Up Orientation
  The CSP target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.
- CSP Target Thickness
  The CSP target thickness is based on interfaces to other parts, tooling constraints and strength considerations.
- CSP Ply Counts
  The CSP ply counts are based on the target lay-up orientations and target thickness.

- **CSP Part Periphery**
  This is the CSP part periphery as dictated by tooling and mating part constraints.

USED AT:	AUTHOR: PAS-C Team & Experts	DATE: 12/5/91		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV	PROJECT: PAS-C	REV: 00	X	DRAFT		PUBLICATION	
	NODE: A23316	TITLE: Produce CSP Skin Ply Stack-Up					



246

A23316: Produce CSP Skin Ply Stack-Up

Activities:

A233161 Resolve CSP Skin Ply Sequence
Resolve the CSP skin ply sequence by showing the laminate layer in the order of build-up from an IML or OML tool.

A233162 Create CSP Skin Ply Tables
Create the CSP skin ply tables based on the sequence input and other pertinent design information.

A233163 Develop CSP Skin Ply Periphery
Develop the CSP skin ply periphery based on tooling constraints in the basic areas, and at the edges, and the geometrical interfaced to other mating parts.

A233164 Attach CSP Skin Ply Callouts
Attach the CSP skin ply callouts to each ply in the CSP skin laminate by assigning a part number to each of the plies.

Inputs:

I1 CSP Skin Part Periphery
This is the CSP skin part periphery based on tooling constraints in the basic areas, and at the edges, and the geometrical interfaces to other mating parts.

Controls:

C1 CSP Skin Ply Counts
The CSP skin ply counts are the desired ply counts based on the target lay-up orientations and the target thickness.

C2 CSP Skin Target Lay-Up Orientation
The CSP skin target lay-up orientation is based on the laminate design rules for 0°, 45°, 90° orientation in the subject area.

Outputs:

O1 CSP Skin Details
The CSP skin details consist of part periphery with callouts and ply table.

- CSP Ply Periphery with Callouts
  This is the CSP ply periphery as dictated by tooling and mating part constraints with unique identifying ply numbers.
- CSP Skin Ply Table
  This CSP skin ply table is the combination of the laminates part and ply numbers, material, fiber orientations, splices and changes.

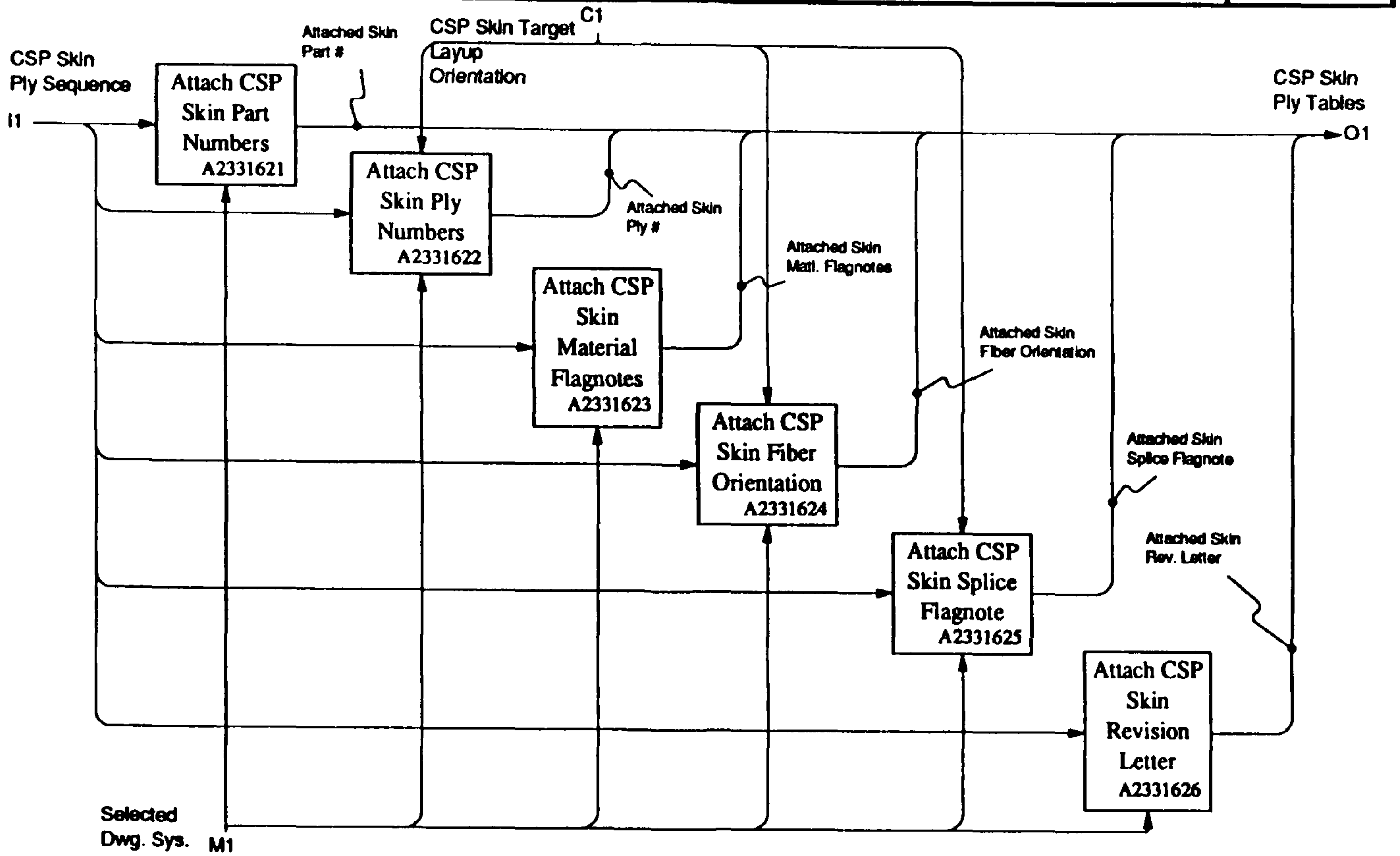
Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSP Skin Ply Sequence
  This is the designed angle ply sequence of the CSP which shows the ply sequence in the laminate layer in the order of build-up from an IML or OML tool.
- CSP Skin Ply Periphery
  This is the CSP skin ply periphery as dictated by tooling and mating part constraints.

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	[ ] WORKING [X] DRAFT	[ ] RECOMMENDED [ ] PUBLICATION	CONTEXT:
	NODE: A233162	TITLE: Create CSP Skin Ply Tables			



148

A233162: Create CSP Skin Ply Tables

Activities:

A2331621 Attach CSP Skin Part Numbers
Attach the assigned CSP Skin part number to the CSP skin ply table.

A2331622 Attach CSP Skin Ply Numbers
Attach the assigned CSP skin ply number to the CSP skin ply table.

A2331623 Attach CSP Skin Material Flagnotes
Attach the various CSP skin material flagnotes to the CSP skin ply table.

A2331624 Attach CSP Skin Fiber Orientation
Attach the angle fiber orientation to the CSP skin ply table.

A2331625 Attach CSP Skin Splice Flagnote
Attach the skin splice flagnotes to the CSP skin ply table.

A2331626 Attach CSP Skin Revision Letter
Attach the appropriate revision letter, of the change status, to the CSP skin ply table.

Inputs:

I1 CSP Skin Ply Sequence
This is the designed angle ply sequence of the CSP which shows the ply sequence in the laminate layer in the order of build-up from an IML or OML tool.

Controls:

C1 CSP Target Lay-Up Orientation
The CSP target lay-up orientation is based on the laminate design rules for %°, 45°, 90° orientation in the subject area.

Outputs:

O1 CSP Skin Ply Table
This CSP skin ply table is the combination of the laminates part and ply numbers, material, fiber orientations, splices and changes.

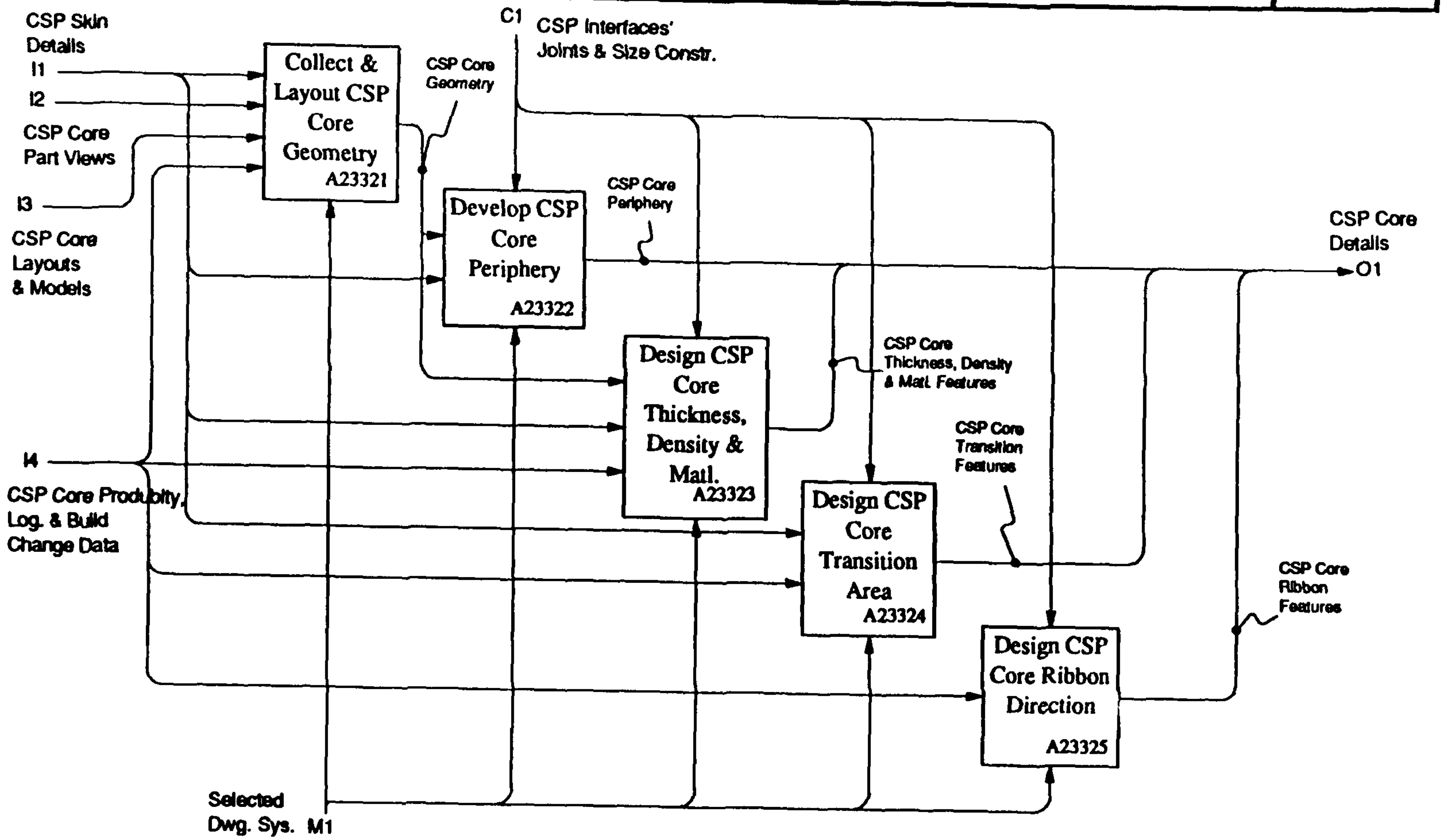
Mechanisms:

M1 *Selected Dwg. Sys.*
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- Attached Skin Part & Ply Number
- Attached Skin Part & Ply Number & Material Flagnotes
- Attached Skin Part & Ply Number & Material Flagnotes & Fiber Orientation
- Attached Skin Part & Ply Number & Material Flagnotes & Fiber Orientation & Splice Flagnote

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
Boeing GD & LTV	NODE: A2332	TITLE: Prepare CSP Core Details	X	DRAFT		PUBLICATION	



A2332: Prepare CSP Core Details

Activities:

A23321 Collect & Layout CSP Core Geometry
Collect all the necessary geometry inputs necessary to layout the core in a core stiffened panel.

A23322 Develop CSP Core Periphery
Develop the CSP core periphery based on its edge band and interface to structural or nonstructural parts.

A23323 Design CSP Core Thickness, Density & Matl.
Design the CSP core thickness, density & material to meet the weight, stress loads and minimum manufacturing constraints.

A23324 Design CSP Core Transition Area
Design the CSP core transition area to resolve the core top and bottom ramp radius along with the ramp angle.

A23325 Design CSP Core Ribbon Direction
Design the CSP's core ribbon direction to take advantage of the load paths due to bending or axial loads.

Inputs:

I1 CSP Skin Details
The CSP skin details consist of part periphery with callouts and ply table.

I2 CSP Core Part Views
The CSP core part views necessary to show the desired features. These include the typical front, top and side views.

I3 CSP Core Layouts & Models
The CSP core layouts and models consist of all the two dimensional and three dimensional geometry of the core.

I4 CSP Core Producibility Log. & Build Change Data
This is the CSP's core producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

Controls:

C1 CSP Interfaces, Joints & Size Constraints
These are the various mating part's envelope constraints and joint configuration. The overall panel size is dictated by the area it supports in the next higher assembly.

Outputs:

O1 CSP Core Details
The CSP core details consist of the core periphery with callouts and ply table.

- CSP Core Periphery
  The CSP core periphery is the edge and internal envelope as constrained by the structural or nonstructural interfaces.
- CSP Core Thickness, Density & Matl. Features
  The CSP core thickness, density & material features of the CSP core.
- CSP Core Transition Features
  This is the designed core top and bottom ramp radius and angle of the CSP core.
- CSP Core Ribbon Features
  This is the designed core ribbon direction as necessary to take the bending or axial load of the CSP.

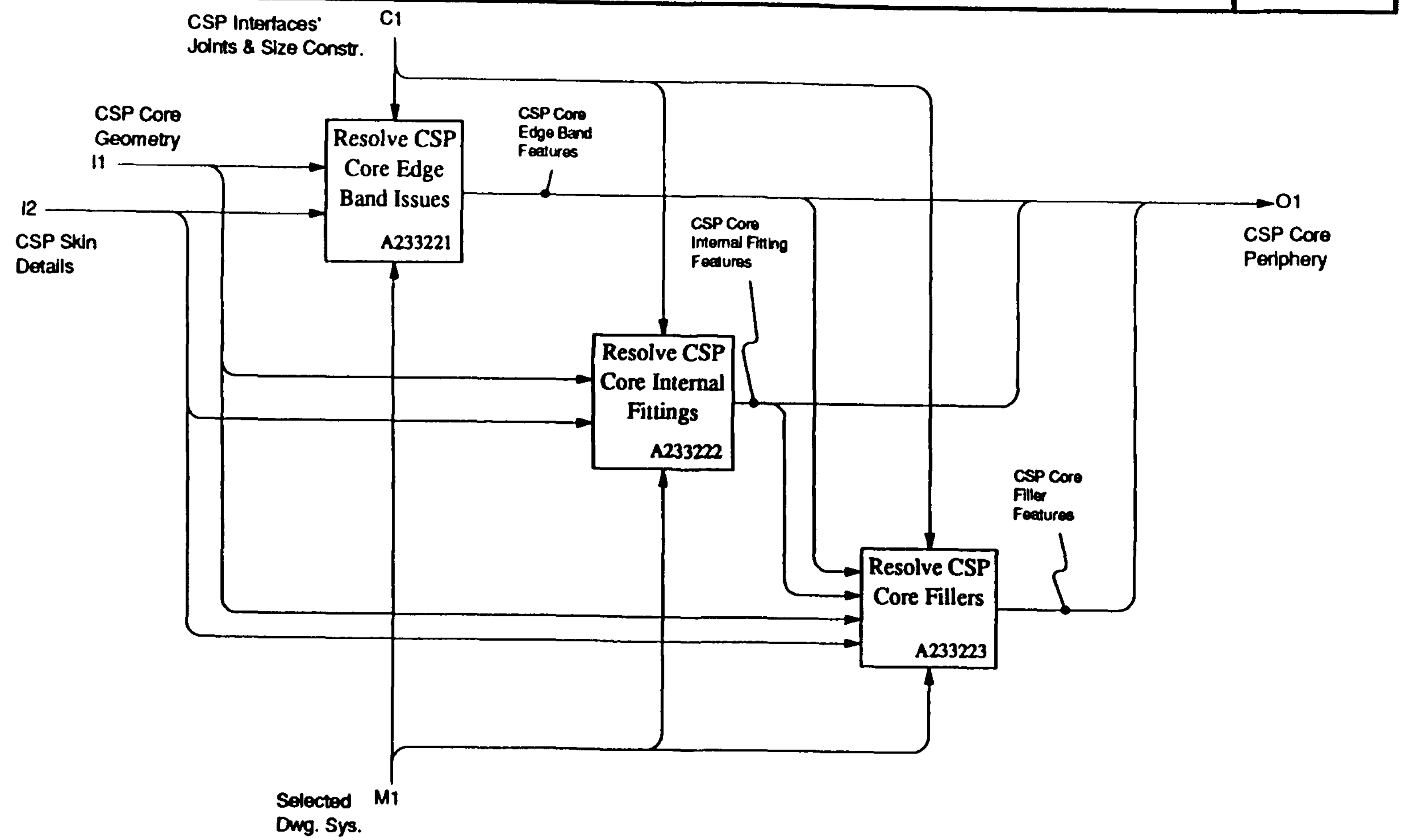
Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSP Core Geometry
  This is the geometry characteristics of the core as configured within the CSP envelope.

USED AT: **Boeing GD & LTV**	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION
	NODE: A23322	TITLE: Develop CSP Core Periphery		CONTEXT:



A23322: Develop CSP Core Periphery

Activities:

A233221 Resolve CSP Core Edge Band Issues
Resolve the CSP core edge band to meet the edge margin of fasteners, clearance for the core layup/placement process and the necessary dimensional tolerances of the core like surface flatness.

A233222 Resolve CSP Core Internal Fittings
Resolve the interface details at the cored based on fittings and mating subassemblies.

A233223 Resolve CSP Core Fillers
Resolve the various stabilizing core filler based on the design requirements. Filler material types include foams, syntactic, putting compound and resins.

Inputs:

I1 CSP Skin Details
The CSP skin details consist of part periphery with callouts and ply table.

I2 CSP Core Part Views
The CSP core part views necessary to show the desired features. These include the typical front, top and side views.

I3 CSP Core Layouts & Models
The CSP core layouts and models consist of all the two dimensional and three dimensional geometry of the core.

I4 CSP Core Producibility Log. & Build Change Data
This is the CSP's core producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

Controls:

C1 CSP Interfaces, Joints & Size Constraints
These are the various mating part's envelope constraints and joint configuration. The overall panel size is dictated by the area it supports in the next higher assembly.

Outputs:

O1 CSP Core Periphery
The CSP core periphery is the edge and internal envelope as constrained by the structural or nonstructural interfaces.

- CSP Core Edge Band Features
  The CSP core edge band features are the core's edge geometry requirements based on fasteners, tolerances and the layup/placement manufacturing process.
- CSP Core Internal Fitting Features
  The CSP core internal fitting features are those joining and mating requirements of other parts to the internal space of the core panel.
- CSP Core Filler Features
  These CSP core filler features are the selected stabilizing materials as selected from either a foam, syntactic, putting compound or resin.

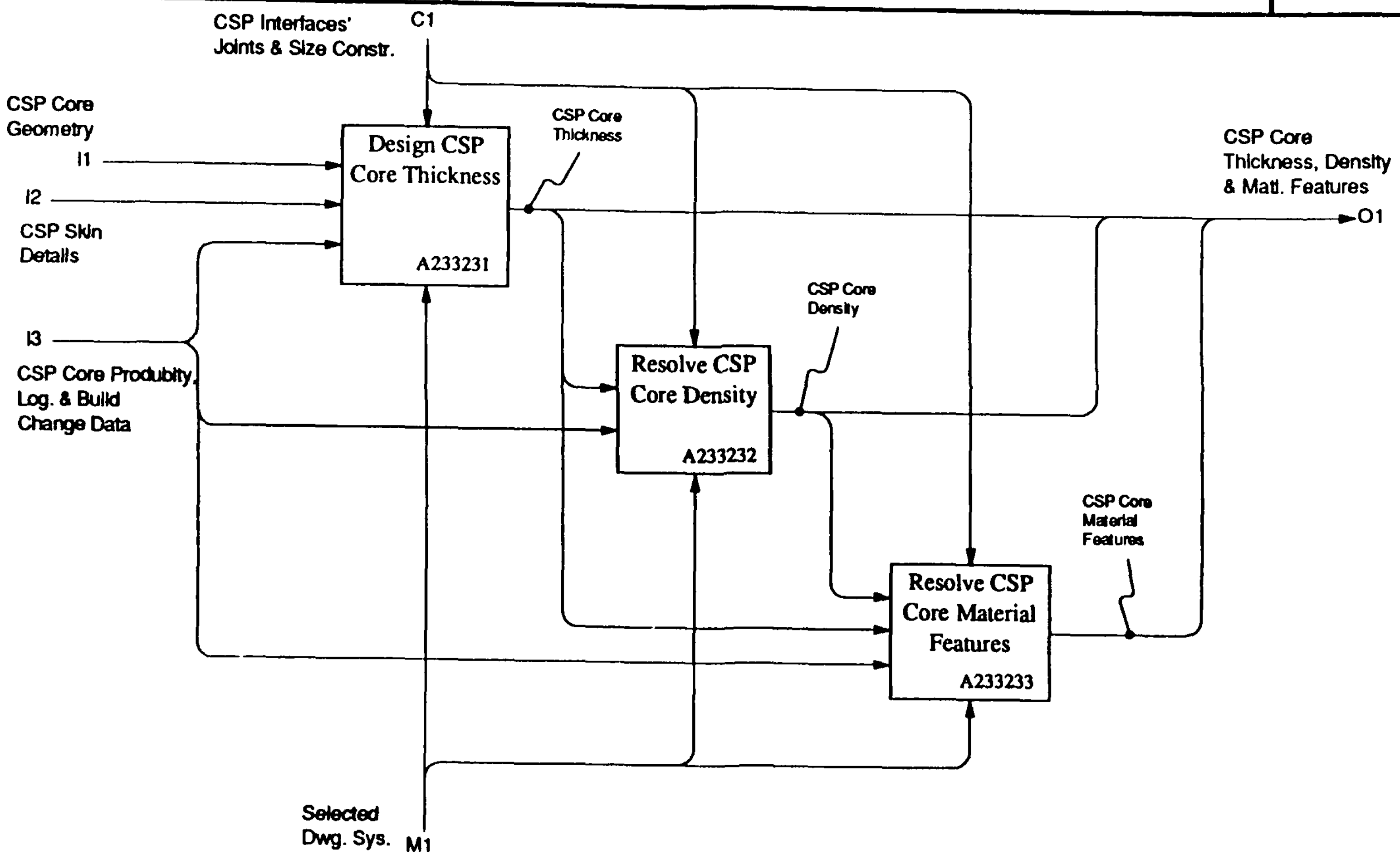
Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSP Core Edge Band Features
  The CSP core edge band features are the core's edge geometry requirements based on fasteners, tolerances and the layup/placement manufacturing process.
- CSP Core Internal Fitting Features
  The CSP core internal fitting features are those joining and mating requirements of other parts to the internal space of the core panel.

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	WORKING	RECOMMENDED	CONTEXT:
	NODE: A23323	TITLE: Design CSP Core Thickness, Density & Matl.	X DRAFT	PUBLICATION	



A23323: Design CSP Core Thickness, Density, & Matl.

Activities:

A233231 Resolve CSP Core Thickness
Design the CSP core thickness based on the performance loads, manufacturing constraints and the other structural or nonstructural interfaces.

A233232 Resolve CSP Core Density
Resolve the core density to meet the weight and stress loads along with meeting the minimum manufacturing constraints.

A233233 Resolve CSP Core Material Features
Resolve the core material features as far as the structural allowables, material compatibility and manufacturing process constraints are concerned.

Inputs:

I1 CSP Core Geometry
The CSP core geometry characteristics of the core as configured within the CSP envelope.

I2 CSP Skin Details
These are the details of the CSP skin as designed to meet the design requirements. This includes the skin periphery, thickness, layup orientation and ply stack-up.

I3 CSP Core Producibility Log. & Build Change Data
This is the CSP's core producibility data as developed, based on manufacturing requirements. This is the logistics data that includes reliability and maintainability studies. Build change data are changes necessary to support the production problems.

Controls:

C1 CSP Interfaces, Joints & Size Constraints
These are the various mating part's envelope constraints and joint configuration. The overall panel size is dictated by the area it supports in the next higher assembly.

Outputs:

O1 CSP Core Thickness, Density and Material Features
This consists of the CSP's core thickness, density and material features.

- CSP Core Thickness
  This is the CSP's core thickness as designed to meet the various requirements.
- CSP Core Density
  This is the CSP's core density as expressed in mass per unit volume.
- CSP Core Material Features
  These are the selected CSP core material features such as the material name and its associated processing specifications.

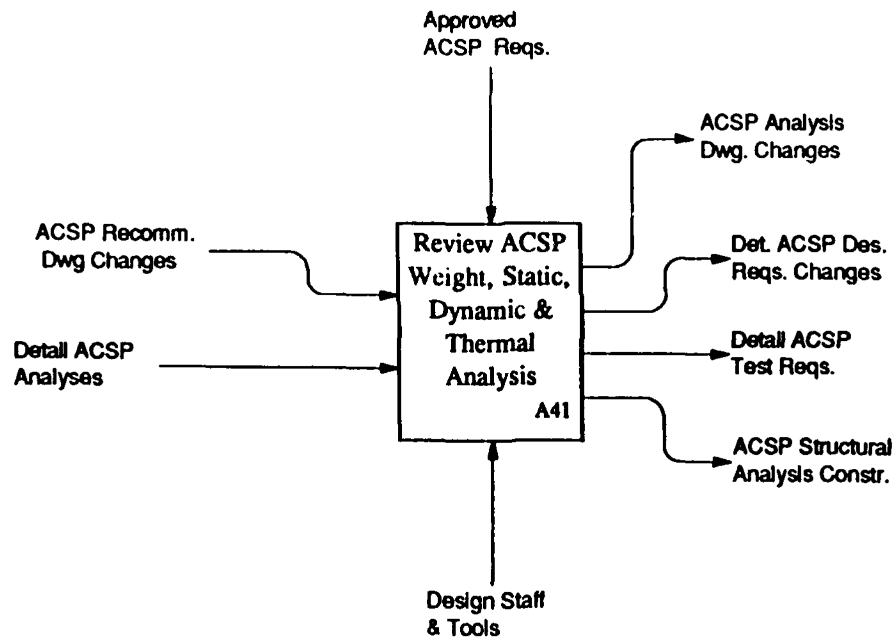
Mechanisms:

M1 Selected Dwg. Sys.
This is the selected drawing system needed to support the detail design development.

Process Interactions:

- CSP Core Thickness
  This is the CSP's core thickness as designed to meet the various requirements.
- CSP Core Density
  This is the CSP's core density as expressed in mass per unit volume.

USED AT: **Boeing GD & LTV**	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	[ ] WORKING [X] DRAFT	[ ] RECOMMENDED [ ] PUBLICATION	CONTEXT:
	NODE: A4	TITLE:			



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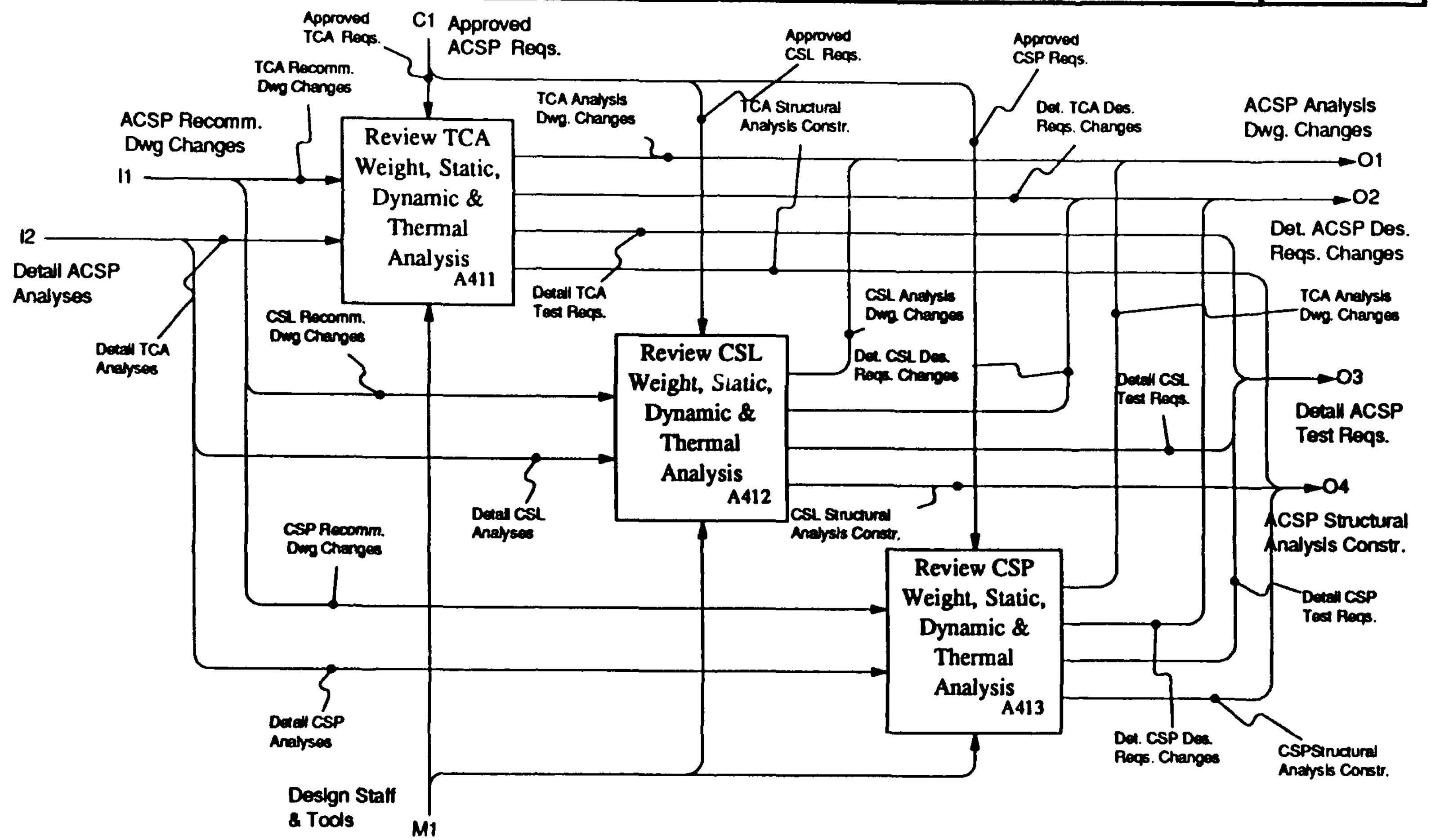
USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	☐ WORKING ☒ DRAFT	☐ RECOMMENDED ☐ PUBLICATION
	NODE: A41	TITLE: Review ACSP Weight, Static, Dynamic & Thermal An		CONTEXT:



218

A41: Review ACSP Weight, Static, Dynamic & Thermal Analysis

Activities:

A411 Review TCA Weight, Static, Dynamic & Thermal Analysis
Review the structural analysis specific to the TCA based on the loads due to weight, static, dynamic and thermal environments.

A412 Review CSL Weight, Static, Dynamic & Thermal Analysis
Review the structural analysis specific to the CSL based on the loads due to weight, static, dynamic and thermal environments.

A413 Review CSP Weight, Static, Dynamic & Thermal Analysis
Review the structural analysis specific to the CSP based on the loads due to weight, static, dynamic and thermal environments.

Inputs:

I1 ACSP Recommended Dwg. Changes
This consists of the TCA, CSL and CSP recommended drawing changes.

- TCA Recommended Dwg. Changes
  These are the recommended TCA drawing changes that are based on the detail structural analysis conducted. This can take the form of redline mark-ups on a paper copy of the drawing.

- CSL Recommended Dwg. Changes
  These are the recommended CSL drawing changes that are based on the detail structural analysis conducted. This can take the form of redline mark-ups on a paper copy of the drawing.

- CSP Recommended Dwg. Changes
  These are the recommended CSP drawing changes that are based on the detail structural analysis conducted. This can take the form of redline mark-ups on a paper copy of the drawing.

I2 Detail ACSP Analysis
This consists of the TCA, CSL and CSP detail analysis.

- Detail TCA Analysis
  These are the detail TCA structural analysis results that were performed on the detail design based on the prescribed loads. This includes the specific strength data along in the allowable margins of safety.

- Detail CSL Analysis
  These are the detail CSL structural analysis results that were performed on the detail design based on the prescribed loads. This includes the specific strength data along in the allowable margins of safety.

- Detail CSP Analysis
  These are the detail CSP structural analysis results that were performed on the detail design based on the prescribed loads. This includes the specific strength data along in the allowable margins of safety.

Controls:

C1 Approved ACSP Requirements
This consists of the TCA, CSL and CSP approved requirements.

- Approved TCA Requirements
  These are all the functional and cross-functional requirements that have been reviewed to be specific to the TCA. These include the technical performance constraints of the various functions along with the envelope features that are desired. All of the pertinent functions within each of the Manage, Design, Build and Support activities are included.

- Approved CSL Requirements
  These are all the functional and cross-functional requirements that have been reviewed to be specific to the CSL. These include the technical performance constraints of the various functions along with the envelope features that are desired. All of the pertinent functions within each of the Manage, Design, Build and Support activities are included.

- Approved CSP Requirements
  These are all the functional and cross-functional requirements that have been reviewed to be specific to the CSP. These include the technical performance constraints of the various functions along with the envelope features that are desired. All of the pertinent functions within each of the Manage, Design, Build and Support activities are included.

Outputs:

O1 TCA Analysis Dwg. Changes

- CSL Analysis Dwg. Changes
  CSL analysis drawing changes are the reviewed recommended analysis drawing changes as done by the detail structural analysis task.

O2 **Det. TCA Des. Reqs. Changes**

These are the detail design requirements changes to the TCA based on the structural analysis [illegible] to the [illegible] that make up the TCA. This [illegible] the enclosure of the cap, angles, filler, fasteners and interface structural analyses.

- Det. CSL Des. Reqs. Changes
  These are the detail design requirements changes to the CSL based on the structural analysis done to the components that make up the CSL. This is inclusive of the skin, fasteners and interface structural analyses.

- Det. CSP Des. Reqs. Changes
  These are the detail design requirements changes to the CSP based on the structural analysis done to the components that make up the CSP. This is inclusive of the skin, core, edge, fasteners and joint/interface structural analyses.

O3 **Det. TCA Test Reqs.**

These are the detail TCA test requirements changes for conducting structural tests to meet some prescribed design load conditions.

- Det. CSL Test Reqs.
  These are the detail CSL test requirements changes for conducting structural tests to meet some prescribed design load conditions.

- Det. CSP Test Reqs.
  These are the detail CSL test requirements changes for conducting structural tests to meet certain design load conditions.

O4 **TCA Structural Analysis Constr.**

These are the reviewed TCA analysis constraints that involve maximum allowable stress and strain margins of the structure along with other pertinent structural performance analysis.

- CSL Structural Analysis Constr.
  These are the reviewed CSL structural analysis constraints that involve maximum allowable stress and strain margins of the structure along with other pertinent structural performance analysis.

- CSP Structural Analysis Constr.
  These are the reviewed CSP analysis constraints that involve maximum allowable stress and strain margins of the structure along with other pertinent structural performance analysis.

Mechanisms:

M1 **Design & Analysis Staff & Tools**

These are the specific people and tools necessary to perform the design and analysis tasks.

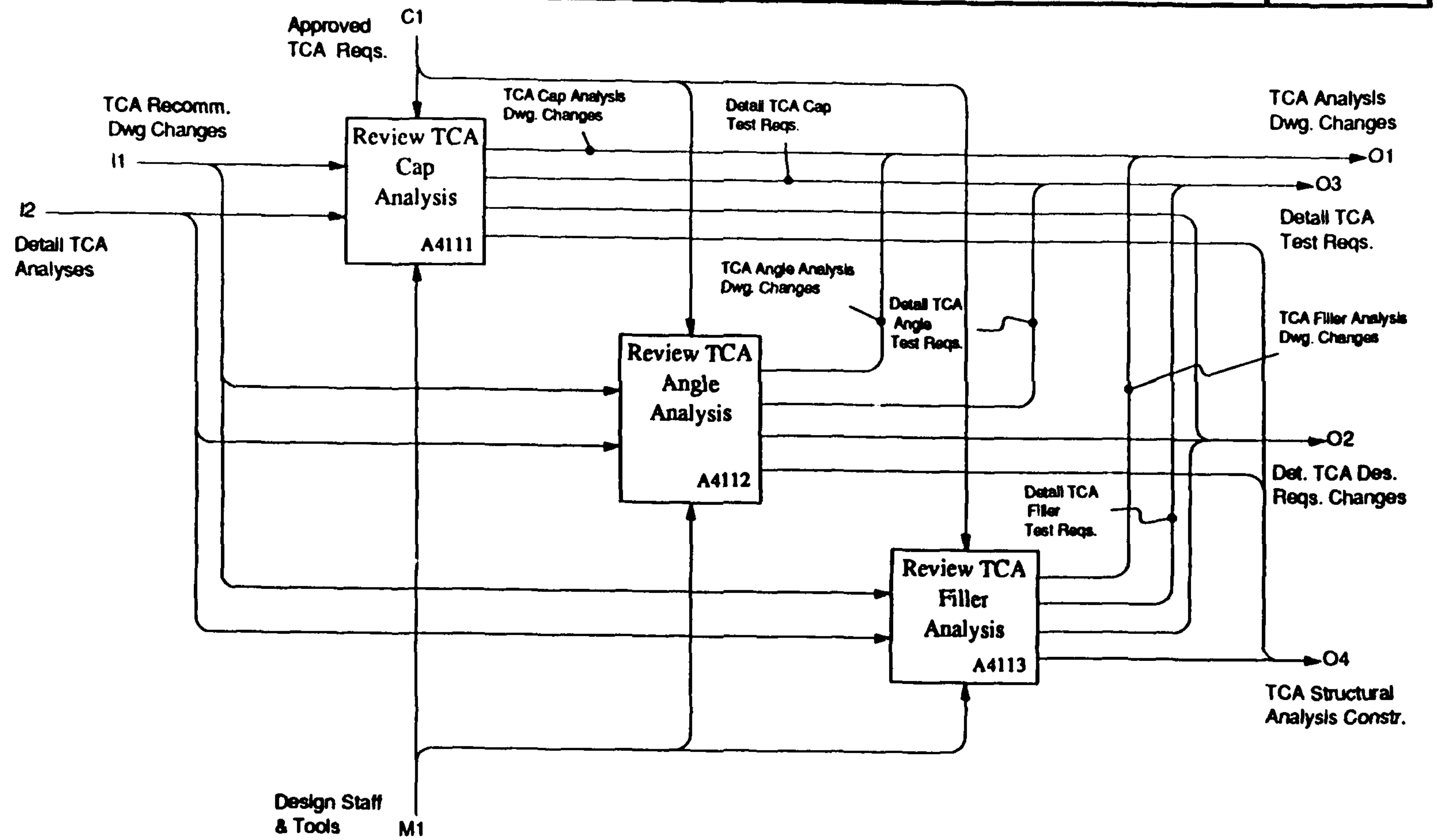
- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

(None)

USED AT: Boeing GD & LTV	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A411	TITLE: Review TCA Weight, Static, Dynamic & Thermal Ana			



7 2

A411: Review TCA Weight, Static, Dynamic & Thermal Analysis

Activities:

A4111 Review TCA Cap Analysis
Review the TCA cap analysis results based on its load bearing capability within the TCA geometry due to the loads transmitted by mating parts. These analyses look at weight, static, dynamic stress and thermal stress.

A4112 Review TCA Angle Analysis
Review the TCA angle analysis results based on the two angles load bearing capability within the TCA geometry due to the loads transmitted by mating parts. These analyses look at weight, static, dynamic stress and thermal stress.

A4113 Review TCA Filler Analysis
Review the TCA filler analysis based on its longitudinal and transverse load carrying capability within the TCA geometry. These analyses look at weight, static, dynamic stress and thermal stress.

Inputs:

I1 TCA Recommended Dwg. Changes
These are the recommended TCA drawing changes that are based on the detail structural analysis conducted. This can take the form of redline mark-ups on a paper copy of the drawing.

I2 Detail TCA Analysis
These are the detail TCA structural analysis results that were performed on the detail design based on the prescribed loads. This includes the specific strength data along in the allowable margins of safety.

Controls:

C1 Approved TCA Requirements
These are all the functional and cross-functional requirements that have been reviewed to be *specific to the TCA. These include the technical performance* constraints of the various functions along with the envelope features that are desired. All of the pertinent functions within each of the Manage, Design, Build and Support activities are included.

Outputs:

O1 TCA Analysis Dwg. Changes

- TCA Cap Analysis Dwg. Changes
  TCA cap analysis drawing changes are the reviewed recommended analysis drawing changes as done by the detail structural analysis task.
- TCA Angle Analysis Dwg. Changes
  TCA angle analysis drawing changes are the reviewed recommended analysis drawing changes as done by the detail structural analysis task.
- TCA Filler Analysis Dwg. Changes
  TCA cap analysis drawing changes are the reviewed recommended analysis drawing changes as done by the detail structural analysis task.

02 Det. TCA Des. Reqs. Changes
These are the detail design requirements changes to the TCA based on the structural analysis done to the components that make up the TCA. This is the enclosure of the cap, angles, filler, fasteners and interface structural analyses.

03 Det. TCA Test Reqs.

- Det. TCA Cap Test Reqs.
  These are the detail TCA cap test requirements for conducting structural tests to meet some prescribed design load conditions.
- Det. TCA Angle Test Reqs.
  These are the detail TCA angle test requirements for conducting *structural tests to meet some prescribed design load conditions.*
- Det. TCA Filler Test Reqs.
  These are the detail TCA filler test requirements for conducting structural tests to meet some prescribed design load conditions.

O4 TCA Structural Analysis Constr.
These are the reviewed TCA analysis constraints that involve maximum allowable stress and strain margins of the structure along with other pertinent structural performance analysis.

Mechanisms:

M1 Design & Analysis Staff & Tools

These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools

  These are the specific people and tools necessary to perform the design tasks.

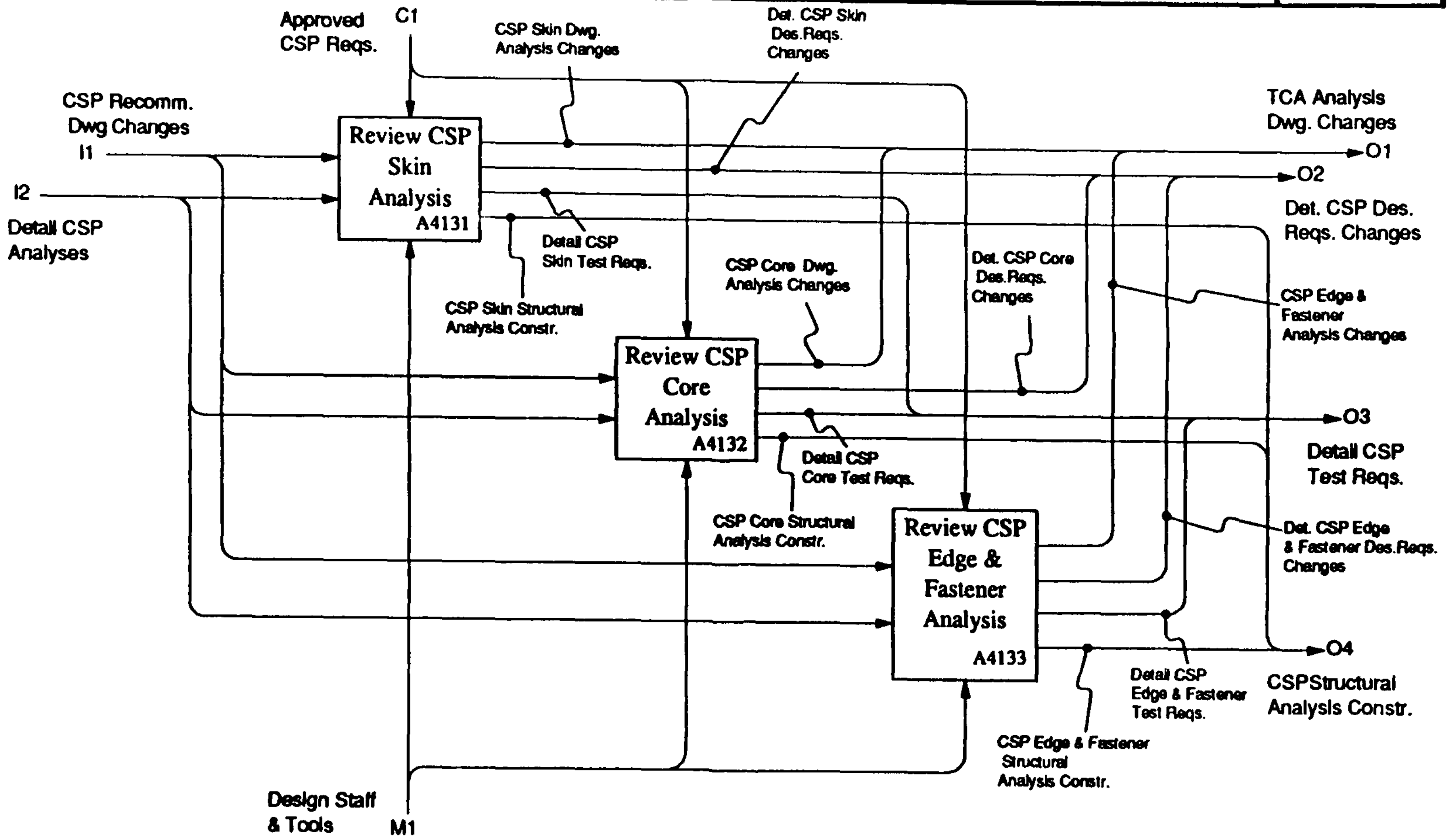
- Analysis Staff & Tools

  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

(None)

USED AT:	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/5/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
Boeing GD & LTV	NODE: A413	TITLE: Review CSP Weight, Static, Dynamic & Thermal Ana			



A413: Review CSP Weight, Static, Dynamic & Thermal Analysis

Activities:

A4131 Review CSP Skin Analysis
Review the CSP skin analysis for the CSP skin based in the loads transmitted by mating parts and the reaction by the core. These analyses look at weight, static, dynamic stress and thermal stress.

A4132 Review CSP Core Analysis
Review the specific structural analyses for the core area as a result of loads transmitted by the skin and other mating parts. These analyses look at weight, static, dynamic stress and thermal stress.

A4133 Review CSP Edge & Fastener Analysis
Review the specific structural analysis for the edge and fastener patterns that result from loads transmitted from mating parts. These analyses look at weight, static, dynamic stress and thermal stress.

Inputs:

I1 CSP Recommended Dwg. Changes
These are the recommended CSP drawing changes that are on the detail analyses.

I2 Detail CSP Analysis
These are the detail CSP structural analysis results that were performed on the detail design based on the prescribed loads. This includes the specific strength data along with the allowable margins of safety.

Controls:

C1 Approved CSP Requirements
These are all the functional and cross-functional requirements that have been reviewed to be specific to the CSP. These include the technical performance constraints of the various functions along with the envelope features that are desired. All of the pertinent functions within each of the Manage, Design, Build and Support activities are included.

Outputs:

O1 CSP Analysis Dwg. Changes
CSP analysis drawing changes are the reviewed recommended analysis drawing changes based on the analysis done and the effects are shown in the form of redline changes on the drawings and associated notes.

02 Det. CSP Des. Reqs. Changes
These are the detail design requirements changes to the CSP based on the structural analysis done to the components that make up the CSP. This is inclusive of the skin, core, edge, fasteners, and joint/interface structural analyses.

03 Det. CSP Test Reqs.
These are the detail CSP test requirements for conducting structural tests to meet certain design load conditions.

O4 CSP Structural Analysis Constr.
These are the reviewed CSP analysis constraints that involve maximum allowable stress and strain margins of the structure along with other pertinent structural performance analysis.

Mechanisms:

M1 Design & Analysis Staff & Tools
These are the specific people and tools necessary to perform the design and analysis tasks.

- Design Staff & Tools
  These are the specific people and tools necessary to perform the design tasks.

- Analysis Staff & Tools
  These are the specific people and tools necessary to perform the analysis tasks.

Process Interactions:

(None)

PART SPECIFIC - ANALYSIS

Part Specific Analysis Activity Listing

A31 Generate ACSP Geometric Attributes
A311 Generate TCA Geometric Attributes
A3111 Generate TCA Equivalent Cross Sectional Area
A3112 Generate TCA Equivalent Cross Sectional Properties
A3113 Generate TCA Equivalent Thicknesses
A312 Generate CSL Geometric Attributes
A3121 Generate CSL Shell Offsets
A3122 Generate CSL Shear Panel Core Area Equivalents
A3123 Generate CSL Equivalent Thicknesses
A313 Generate CSP Geometric Attributes
A3131 Generate CSP Shell Offsets
A3132 Generate CSP Shear Panel Core Area Equivalents
A3133 Generate CSP Solid Element Core Equivalent Properties
A3134 Generate CSP Equivalent Thicknesses
A34 Input ACSP Anisotropic Material Property Matrices
A341 Input TCA Anisotropic Material Property Matrices
A3411 Input TCA Equivalent Cross Sectional Area Modulus of Elasticity
A3412 Input TCA Cross Sectional Anisotropic Material Property Matrices
A3413 Input TCA Shell Element Anisotropic Material Property Matrices
A342 Input CSL Anisotropic Material Property Matrices
A3421 Input CSL Shell Element Anisotropic Material Property Matrices
A3422 Input CSL Solid Element Anisotropic Material Property Matrices
A343 Input CSP Anisotropic Material Property Matrices
A3431 Input CSP Face Sheet Anisotropic Material Property Matrices
A3432 Input CSP Core Anisotropic Material Property Matrices
A3433 Input CSP Face Sheet and Core Anisotropic Material Property Matrices
A31 Conduct ACSP Static Strength Analysis
A311 Conduct TCA Static Strength Analysis
A3111 Conduct TCA Composite Joint Analysis
A3112 Conduct TCA Composite Fastener Pull-Through Analysis
A3113 Conduct TCA Composite Cutout Analyses
A3114 Conduct TCA Composite Point Stress Analysis
A3115 Conduct TCA Beam Buckling and Crippling Analyses
A3116 Conduct TCA Beam Stiffener Pull-off Analyses
A312 Conduct CSL Static Strength Analyses
A3121 Conduct CSL Composite Joint Analyses
A3122 Conduct CSL Composite Fastener Pull-Through Analyses
A3123 Conduct CSL Composite Cutout Analyses
A3124 Conduct CSL Composite Point Stress Analysis
A3125 Conduct CSL Panel Analyses
A313 Conduct CSP Static Strength Analyses

- A3131 Conduct CSP Composite Joint Analyses
- A3132 Conduct CSP Composite Fastener Pull-Through Analyses
- A3133 Conduct CSP Composite Cutout Analyses
- A3134 Conduct CSP Composite Point Stress Analysis
- A3135 Conduct CSP Panel Analyses

A32 Define ACSP Structural Configuration

- A321 Define TCA Structural Configuration
  - A3211 Define TCA Initial Ply Orientations
  - A3212 Define TCA Initial Ply Distributions
  - A3213 Define TCA Initial Stiffener Geometry
- A322 Define CSL Structural Configuration
  - A3221 Define CSL Initial Ply Orientation
  - A3222 Define CSL Initial Ply Distribution
- A323 Define CSP Structural Configuration
  - A3231 Define CSP Initial Ply Orientations
  - A3232 Define CSP Initial Ply Distribution
  - A3233 Define CSP Initial Core Geometry
  - A3234 Define CSP Initial Core Orientation
  - A3235 Define CSP Initial Core Distribution

A42 Optimize ACSP Structural Configuration

- A421 Optimize TCA Structural Configuration
  - A4211 Optimize TCA Initial Ply Orientations
  - A4212 Optimize TCA Initial Ply Distributions
  - A4213 Optimize TCA Initial Stiffener Geometry
- A422 Optimize CSL Structural Configuration
  - A4221 Optimize CSL Initial Ply Orientation
  - A4222 Optimize CSL Initial Ply Distribution
- A423 Optimize CSP Structural Configuration
  - A4231 Optimize CSP Initial Ply Orientations
  - A4232 Optimize CSP Initial Ply Distribution
  - A4233 Optimize CSP Initial Core Geometry
  - A4234 Optimize CSP Initial Core Orientation
  - A4235 Optimize CSP Initial Core Distribution

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00		WORKING		RECOMMENDED
			X	DRAFT		PUBLICATION
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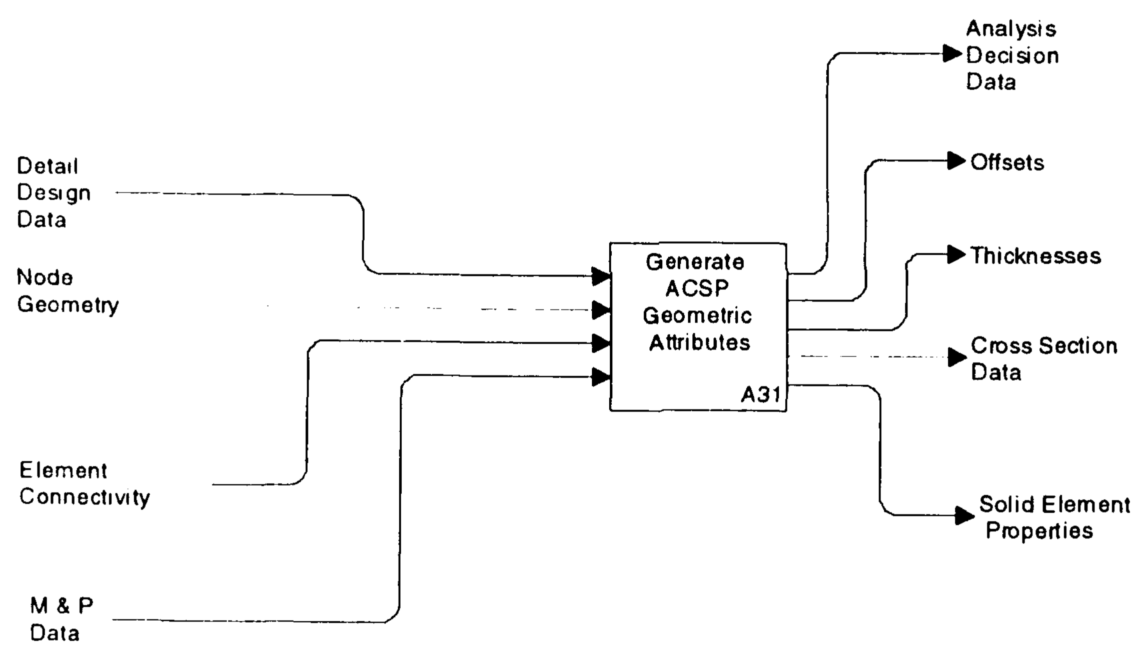


270

A-3:

Activities:

A31 Generate ACSP Geometric Attributes
Generate element geometric attributes such as thicknesses for surface elements, and areas and cross-section dimensions for curve elements.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 Node Geometry
The geometric position data for the node, and any necessary identifiers.

I3 Element Connectivity
The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.

I4 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP

O2 Offsets
Any offsets needed to describe the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

O3 Thicknesses
The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

O4 Cross-section Data
Data describing the extensional and beam bending behavior of a TCA.

O5 Solid Element Properties
The properties necessary to describe the structural response of a volume element.

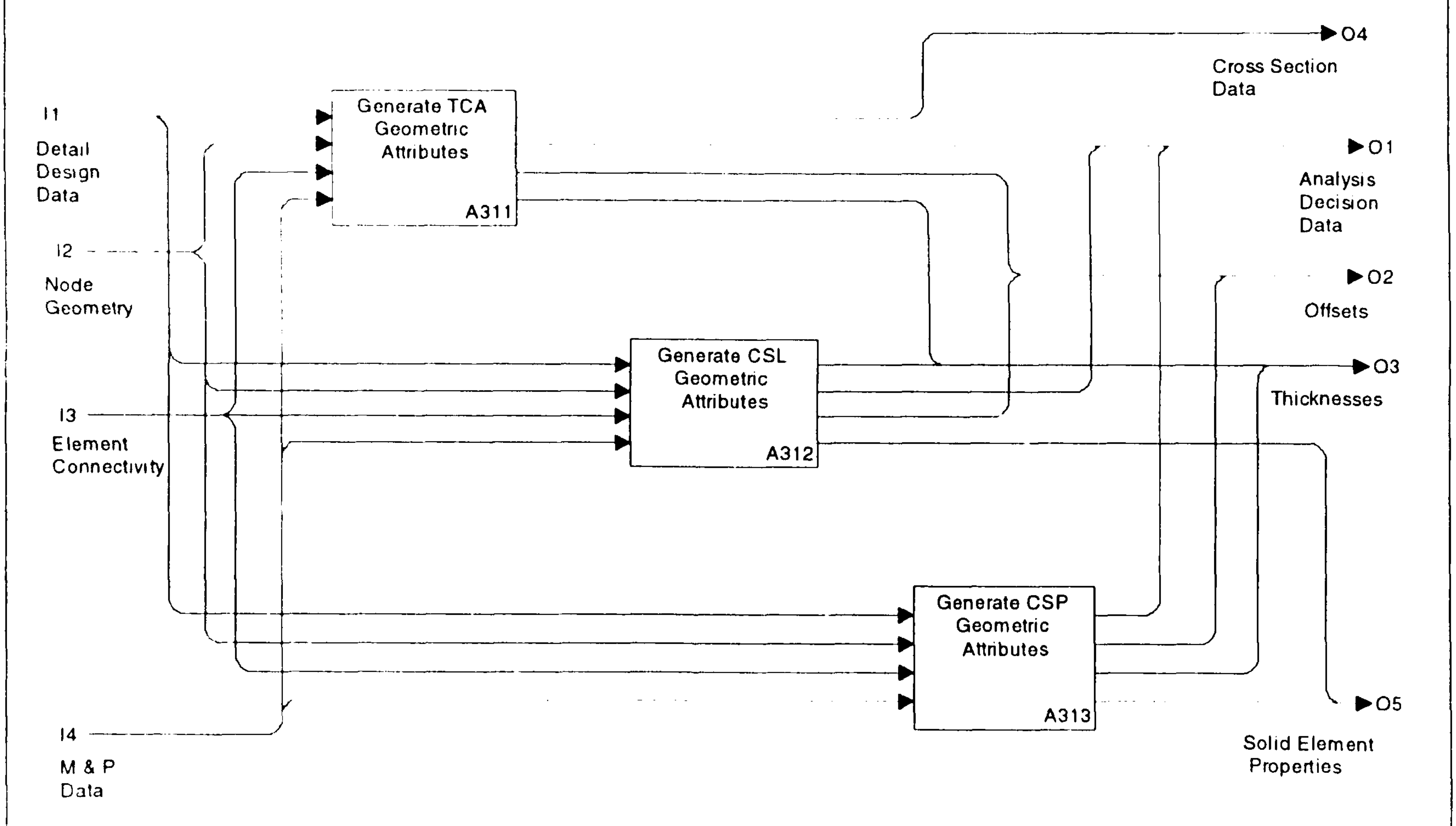
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A31	TITLE: Generate ACSP Geometric Attributes			



A-31: Generate ACSP Geometric Attributes

Activities:

A311 Generate TCA Geometric Attributes
Generate element geometric attributes such as thicknesses for surface elements, and areas and cross-section dimensions for curve elements.

A312 Generate CSL Geometric Attributes
Generate element geometric attributes such as thicknesses for surface elements.

A313 Generate CSP Geometric Attributes
Generate element geometric attributes such as thicknesses for surface elements.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 Node Geometry
The geometric position data for the node, and any necessary identifiers.

I3 Element Connectivity
The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.

I4 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP

O2 Offsets
Any offsets needed to describe the attachment of an element to a node that is not *on the axis of the element coordinate system (for curve elements)* or on the plane of the element coordinate system (for surface elements) of the element.

O3 Thicknesses
The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

O4 Cross-section Data
Data describing the extensional and beam bending behavior of a TCA.

O5 Solid Element Properties
The properties necessary to describe the structural response of a volume element.

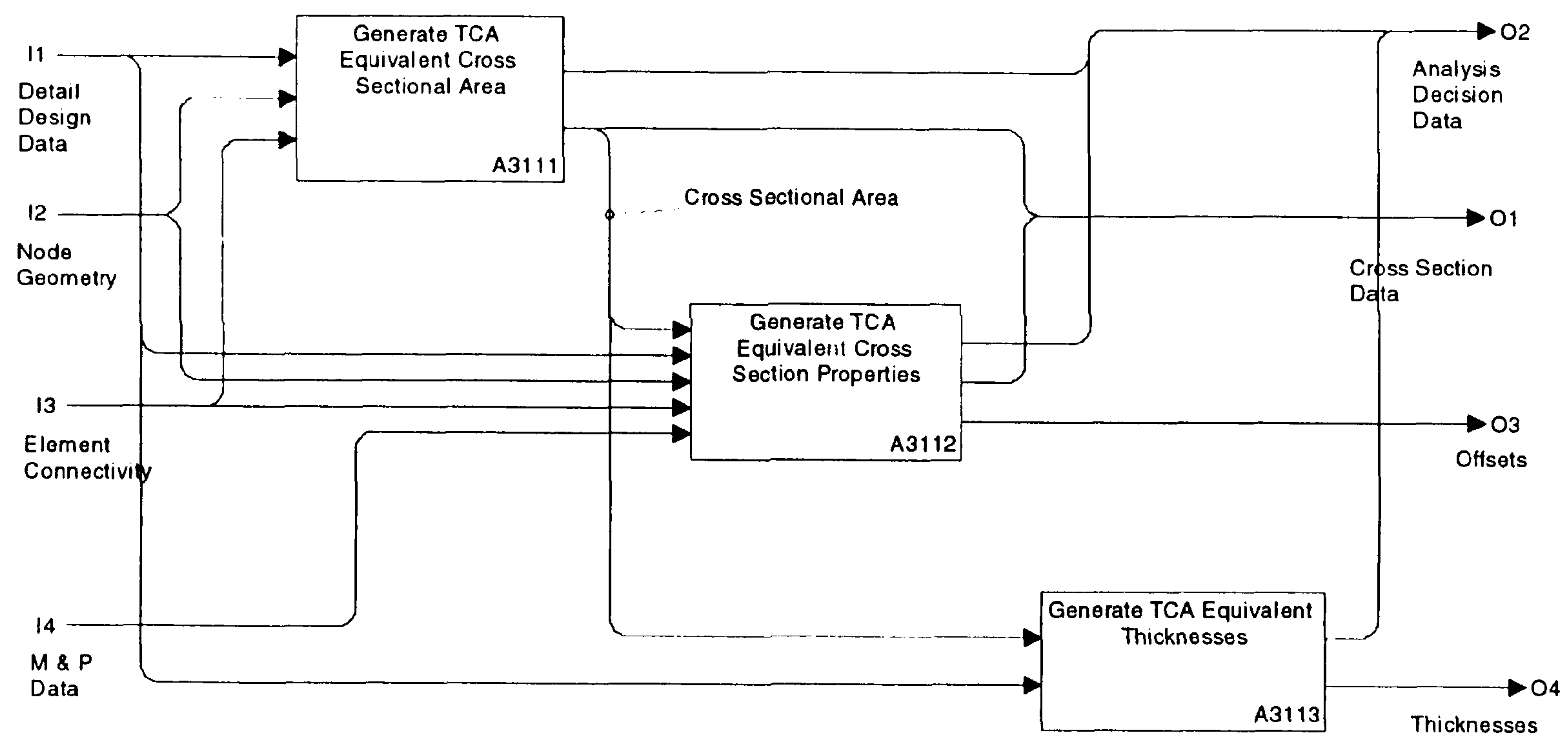
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00		WORKING		RECOMMENDED
			X	DRAFT		PUBLICATION
	NODE: A311	TITLE: Generate TCA Geometric Attributes				CONTEXT:



A-311: Generate TCA Geometric Attributes

Activities:

A3111 Generate TCA Equivalent Cross Sectional Area
Generate equivalent cross sectional area of the stiffener for curve elements.

A3112 Generate TCA Equivalent Cross Sectional Properties
Generate equivalent cross sectional beam properties of the stiffener for curve elements.

A3113 Generate TCA Equivalent Thicknesses
Generate equivalent thicknesses for surface elements used to explicitly model the stiffener.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 Node Geometry
The geometric position data for the node, and any necessary identifiers.

I3 Element Connectivity
The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.

I4 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

(None)

Outputs:

O1 Cross-section Data
Data describing the extensional and beam bending behavior of a TCA.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O3 Offsets
Any offsets needed to describe the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

O4 Thicknesses
The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

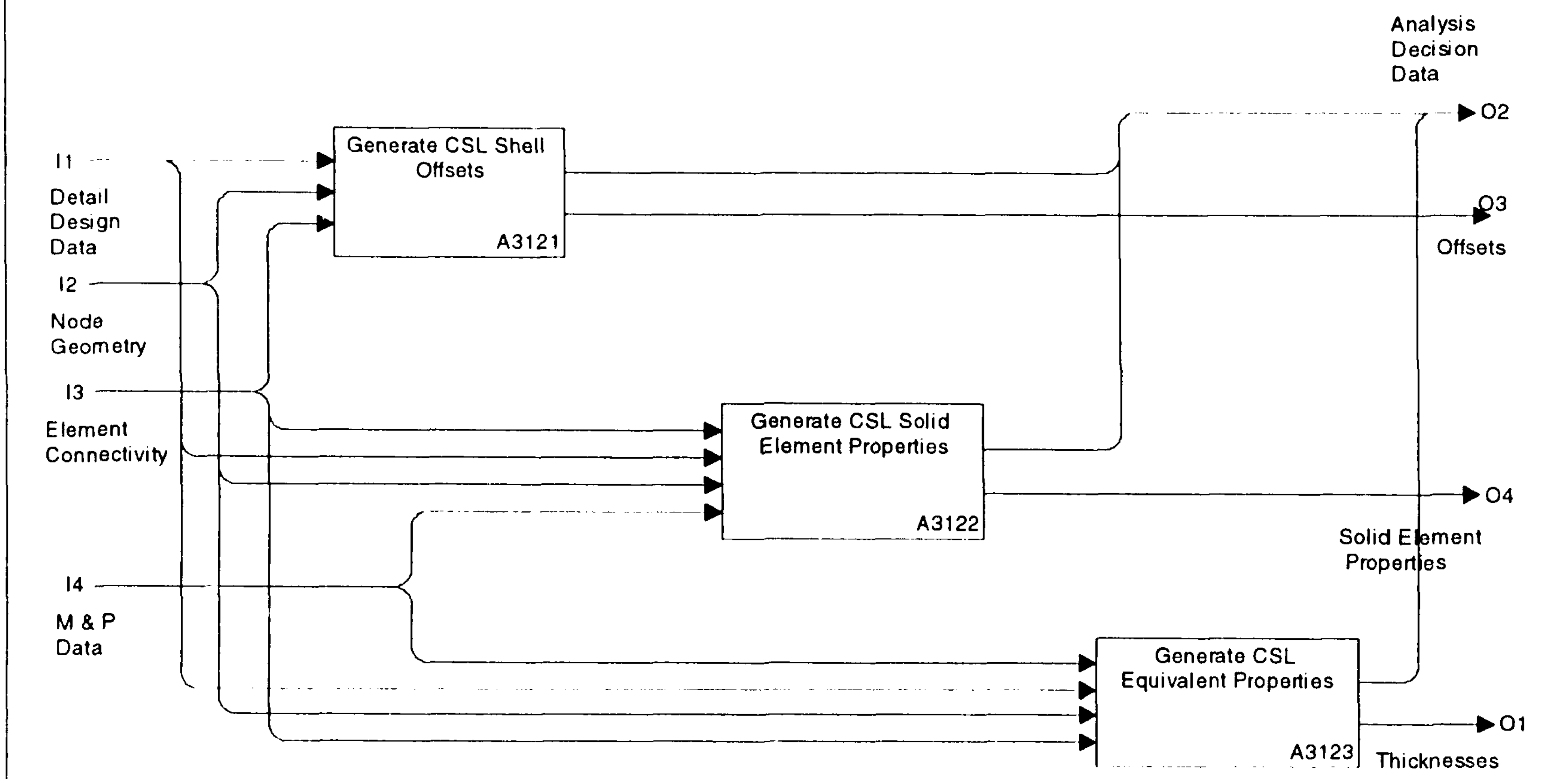
Mechanisms:

(None)

Process Interactions:

- Cross Section Area
  Data describing the cross sectional area of a TCA.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING I DRAFT	RECOMMENDED PUBLICATION
	NODE: A312	TITLE: Generate CSL Geometric Attributes		CONTEXT:



710

A-312: Generate CSL Geometric Attributes

Activities:

A3121 Generate CSL Shell Offsets
Generate shell offsets for surface elements to model off thickness centriod attachment.

A3122 Generate CSL Shear Panel Core Area Equivalents
Generate shear panel core area equivalents for surface elements.

A3123 Generate CSL Equivalent Thicknesses
Generate equivalent thicknesses for surface elements.

Inputs:

I1 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 Node Geometry
The geometric position data for the node, and any necessary identifiers.

I3 Element Connectivity
The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.

I4 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

(None)

Outputs:

O1 Thicknesses
The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O3 Offsets
Any offsets needed to describe the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

O4 Solid Element Properties
The properties necessary to describe the structural response of a volume element.

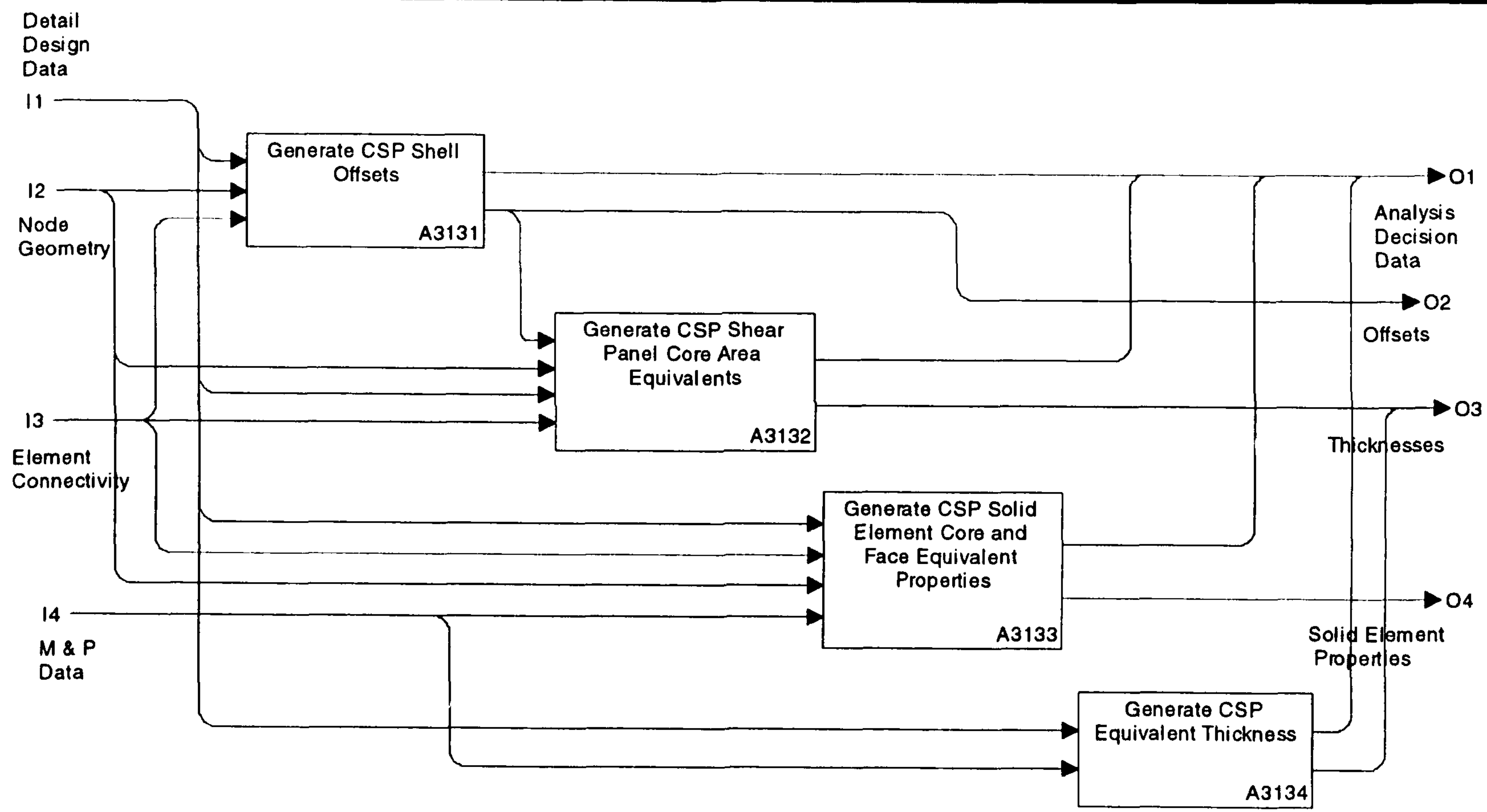
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION
	NODE: A313	TITLE: Generate CSP Geometric Attributes		CONTEXT:



A-313: Generate CSP Geometric Attributes

Activities:

A3131 **Generate CSP Shell Offsets**
Generate shell offsets for surface elements to model off thickness centroid attachment.

A3132 **Generate CSP Shear Panel Core Area Equivalents**
Generate shear panel core area equivalents for surface elements.

A3133 **Generate CSP Solid Element Core Equivalent Properties**
Generate the equivalent core properties for solid elements.

A3134 **Generate CSP Equivalent Thicknesses**
Generate equivalent thicknesses (smearing core and face sheets) for surface elements.

Inputs:

I1 **Detail Design Data**
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I2 **Node Geometry**
The geometric position data for the node, and any necessary identifiers.

I3 **Element Connectivity**
The references to the nodes that the element is connected to, and any necessary identifiers for the element itself.

I4 **M & P Data**
All of the data needed to describe the physical responses of a composite material or its plies.

Controls:

(None)

Outputs:

O1 **Analysis Decision Data**
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O2 **Offsets**
Any offsets needed to describe the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

O3 **Thicknesses**
The thickness of a surface element perpendicular to the surface of the element. A surface element idealizes a volume continuum as a surface with a thickness distribution.

O4 **Solid Element Properties**
The properties necessary to describe the structural response of a volume element.

Mechanisms:

(None)

Process Interactions:

- **Offsets**
  Any offsets needed to describe the attachment of an element to a node that is not on the axis of the element coordinate system (for curve elements) or on the plane of the element coordinate system (for surface elements) of the element.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
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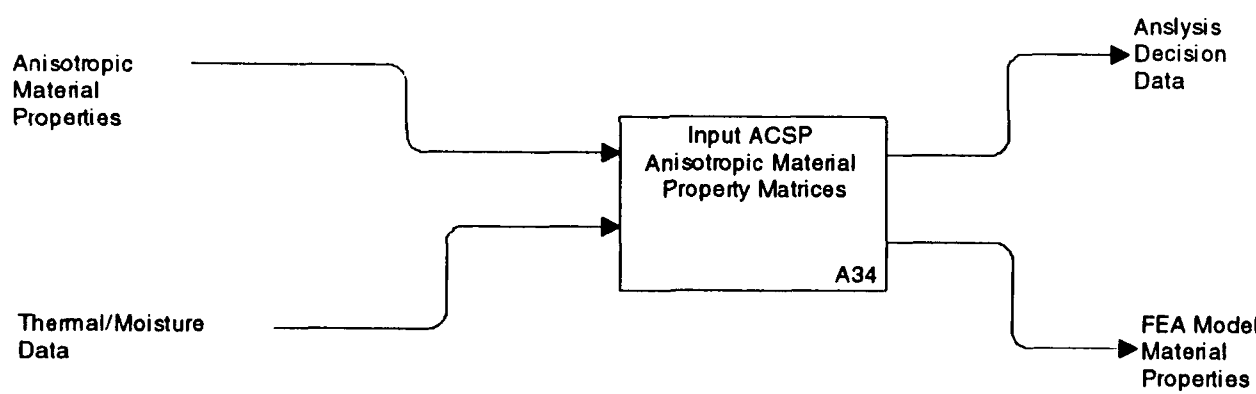

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A-3:

Activities:

A34 Input ACSP Anisotropic Material Property Matrices
Input material property matrices data.

Inputs:

I1 Anisotropic Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion matrices that describe the response of a composite material.

I2 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O1 FEA Model Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

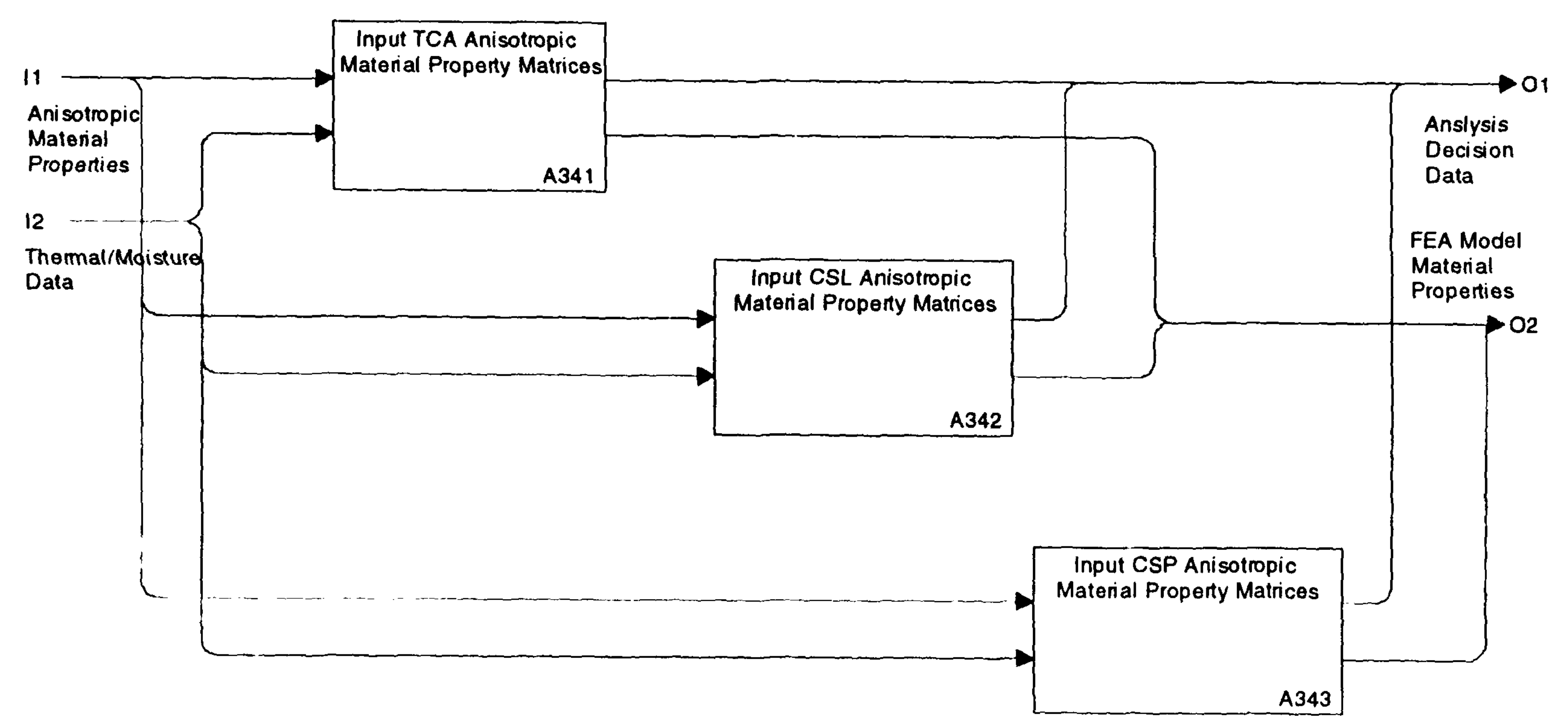
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	[ ] WORKING [X] DRAFT	[ ] RECOMMENDED [ ] PUBLICATION	CONTEXT:
	NODE: A34	TITLE: Input ACSP Anisotropic Material Property Matrice			



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A-34: Input ACSP Anisotropic Material Property Matrices

Activities:

A341 Input TCA Anisotropic Material Property Matrices
Input material property matrices data.

A342 Input CSL Anisotropic Material Property Matrices
Input material property matrices data.

A343 Input CSP Anisotropic Material Property Matrices
Input material property matrices data.

Inputs:

I1 Anisotropic Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion matrices that describe the response of a composite material.

I2 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O1 FEA Model Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

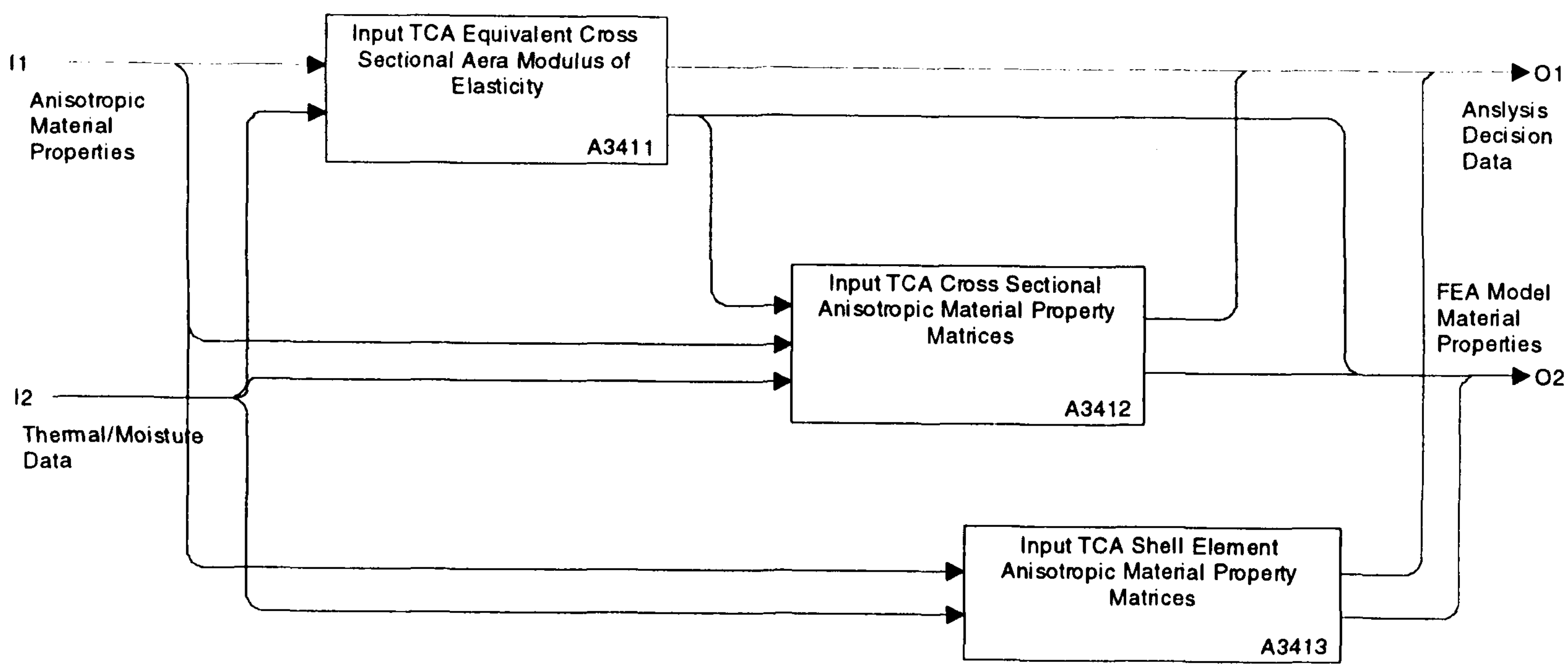
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A341	TITLE: Input TCA Anisotropic Material Property Matrices			



A-341: Input TCA Anisotropic Material Property Matrices

Activities:

A3411 Input TCA Equivalent Cross Sectional Area Modulus of Elasticity
Input the equivalent modulus of elasticity appropriate for idealizing the stiffener as only a curve element with extensional stiffness.

A3412 Input TCA Cross Sectional Anisotropic Material Property Matrices
Input the anisotropic cross sectional beam properties matrices data.

A3413 Input TCA Shell Element Anisotropic Material Property Matrices
Input shell element (for when the stiffener walls are explicitly modelled with surface elements) material property matrices data.

Inputs:

I1 Anisotropic Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion matrices that describe the response of a composite material.

I2 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O1 FEA Model Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

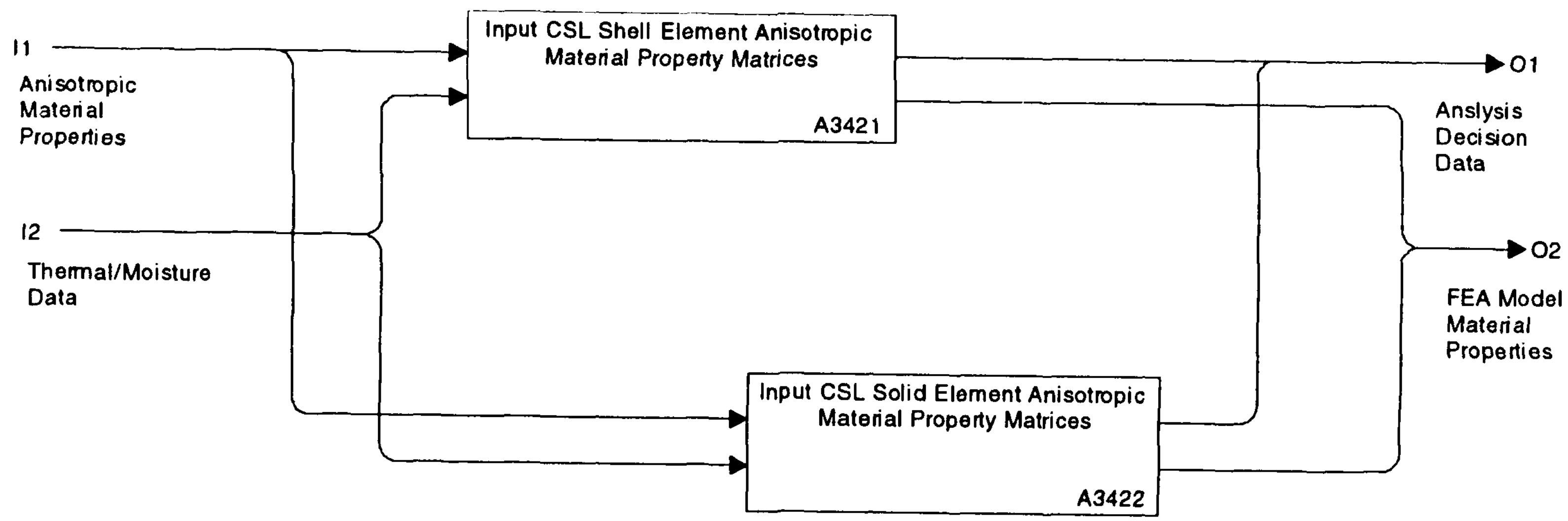
Mechanisms:

(None)

Process Interactions:

- FEA Model Material Properties
  The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00		WORKING		RECOMMENDED	CONTEXT:
			X	DRAFT		PUBLICATION	
	NODE: A342	TITLE: Input CSL Anisotropic Material Property Matrices					



A-342: Input CSL Anisotropic Material Matrices

Activities:

A3421 Input CSL Shell Element Anisotropic Material Property Matrices
Input material property matrices data appropriate for surface elements.

A3422 Input CSL Solid Element Anisotropic Material Property Matrices
Input material property matrices data appropriate for volume elements.

Inputs:

I1 Anisotropic Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion matrices that describe the response of a composite material.

I2 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O1 FEA Model Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

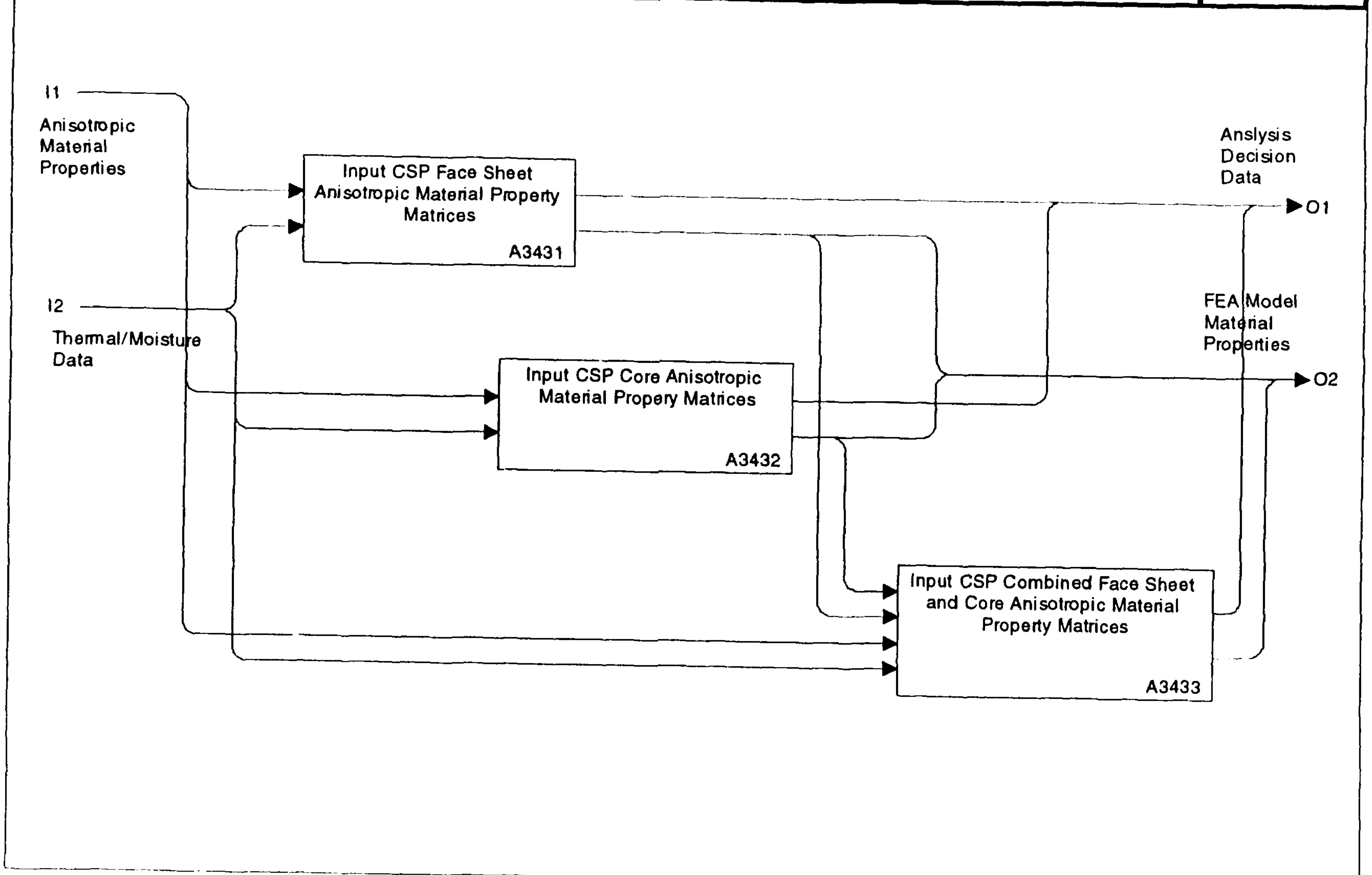
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A343	TITLE: Input CSP Anisotropic Material Property Matrices			



A-343: Input CSP Anisotropic Material Matrices

Activities:

A3431 Input CSP Face Sheet Anisotropic Material Property Matrices
Input face sheet material property matrices data.

A3432 Input CSP Core Anisotropic Material Property Matrices
Input core material property matrices data.

A3433 Input CSP Face Sheet and Core Anisotropic Material Property Matrices
Input face sheet and core (smeared together) material property matrices data.

Inputs:

I1 Anisotropic Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion matrices that describe the response of a composite material.

I2 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

Controls:

(None)

Outputs:

O1 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

O1 FEA Model Material Properties
The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

Mechanisms:

(None)

Process Interactions:

- FEA Model Material Properties
  The two or three dimensionally anisotropic elastic and thermal expansion properties that describe the response of a composite material.

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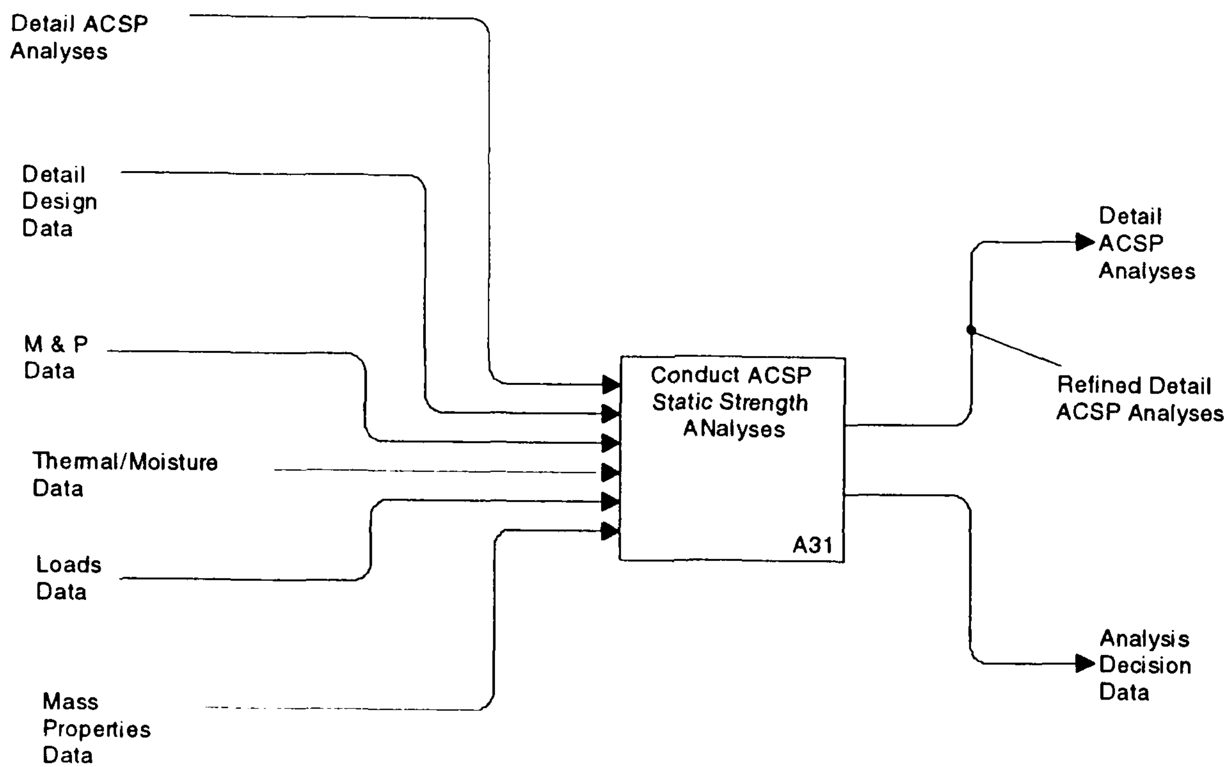
	NODE: A3	TITLE:			



294

A-3:

Activities:

A31 Conduct ACSP Static Strength Analyses
Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

Inputs:

I1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I2 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I3 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

I4 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I5 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I6 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

Controls:

(None)

Outputs:

O1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- Refined ACSP Analyses
  All analysis output data from Detail Analysis including:
  - Deflections
    The displacements of the nodes of the finite element model that result from a finite element analysis.
  - Failure Location/Mode
    The location and mode of failure around a fastener hole in a joint analysis.
  - Margins of Safety
    A ratio of actual to allowable stress or strain. A ratio greater than one means that the value of stress or strain will meet the design criteria.
  - Ply Percentages/Orientations
    The orientations of the plies in an ACSP, and the associated percentages of the total thickness.
  - Required Thickness/Minimum Gage
    Either the required thickness or the minimum gage to meet the margin of safety criteria.
  - Secondary Loads
    The loads applied to a panel resulting to response to out of plane structural response.
  - Stiffener Runout
    The twisting of a TCA due to deflection under load.
  - Stress/Strain Data
    The stress and strain data from stiffener pull-off analyses and tests.

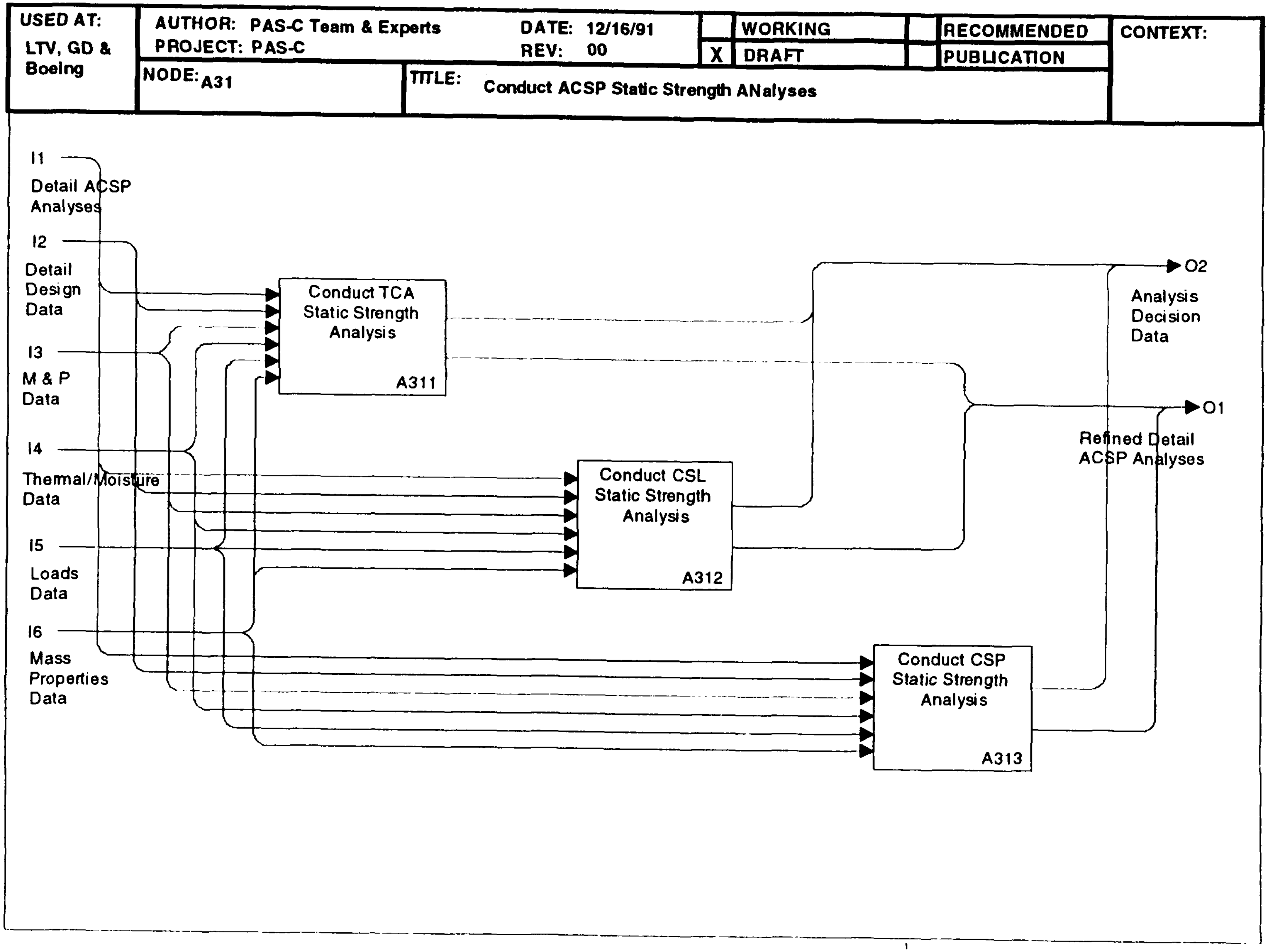
O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

Mechanisms:

(None)

Process Interactions:

(None)


USED AT:
LTV, GD & Boeing
AUTHOR: PAS-C Team & Experts
PROJECT: PAS-C
DATE: 12/16/91
REV: 00
WORKING
X DRAFT
RECOMMENDED
PUBLICATION
CONTEXT:
NODE: A31
TITLE: Conduct ACSP Static Strength ANalyses
I1 Detail ACSP Analyses
I2 Detail Design Data
I3 M & P Data
I4 Thermal/Moisture Data
I5 Loads Data
I6 Mass Properties Data
Conduct TCA Static Strength Analysis
A311
Conduct CSL Static Strength Analysis
A312
Conduct CSP Static Strength Analysis
A313
O2 Analysis Decision Data
O1 Refined Detail ACSP Analyses

248

A-31: Conduct ACSP Static Strength Analyses

Activities:

A311 Conduct TCA Static Strength Analyses
Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A312 Conduct CSL Static Strength Analyses
Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A313 Conduct CSP Static Strength Analyses
Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

Inputs:

I1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I2 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I3 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

I4 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I5 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I6 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

Controls:

(None)

Outputs:

01 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- Refined ACSP Analyses
  All analysis output data from Detail Analysis including:
  - Deflections
    The displacements of the nodes of the finite element model that result from a finite element analysis.
  - Failure Location/Mode
    The location and mode of failure around a fastener hole in a joint analysis.
  - Margins of Safety
    A ratio of actual to allowable stress or strain. A ratio greater than one means that the value of stress or strain will meet the design criteria.
  - Ply Percentages/Orientations
    The orientations of the plies in an ACSP, and the associated percentages of the total thickness.
  - Required Thickness/Minimum Gage
    Either the required thickness or the minimum gage to meet the margin of safety criteria.
  - Secondary Loads
    The loads applied to a panel resulting to response to out of plane structural response.
  - Stiffener Runout
    The twisting of a TCA due to deflection under load

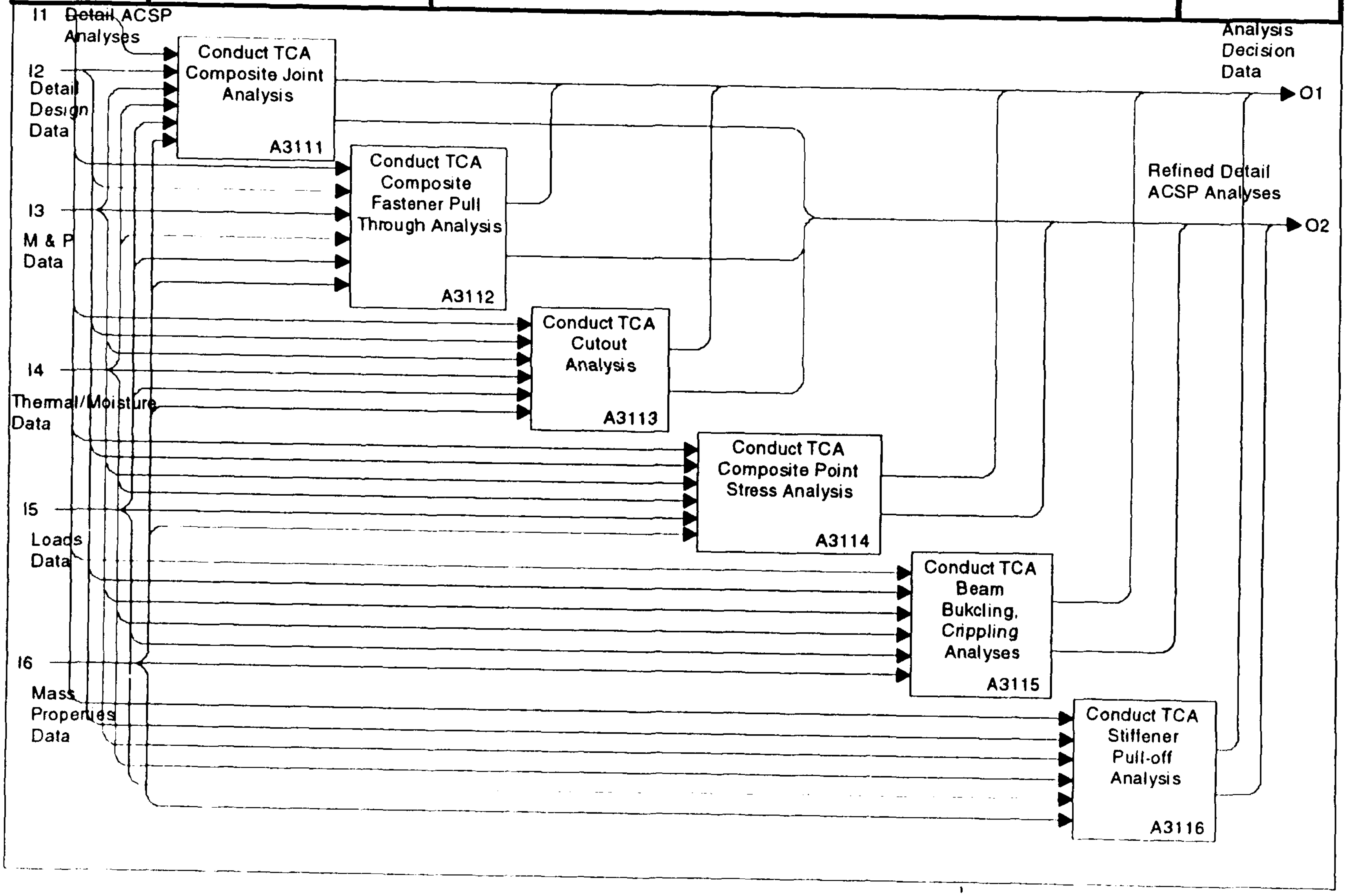
- Stress/Strain Data
  The stress and strain data from stiffener pull-off analyses and tests.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

Mechanisms:
(None)

Process Interactions:
(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A311	TITLE: Conduct TCA Static Strength Analysis			



302

A-311: Conduct TCA Static Strength Analyses

Activities:

A3111 Conduct TCA Composite Joint Analyses
Conduct joint analyses to augment the finite element analyses of the structural part.

A3112 Conduct TCA Composite Fastener Pull-Through Analyses
Conduct fastener pull through analyses to augment the finite element analyses of the structural part.

A3113 Conduct TCA Composite Cutout Analyses
Conduct cutout analyses to augment the finite element analyses of the structural part.

A3114 Conduct TCA Composite Point Stress Analysis
Conduct point stress analyses to augment the finite element analyses of the structural part.

A3115 Conduct TCA Beam Buckling and Crippling Analyses
Conduct stiffener buckling and crippling analyses to augment the finite element analyses of the structural part.

A3116 Conduct TCA Beam Stiffener Pull-off Analyses
Conduct stiffener pull-off analyses to augment the finite element analyses of the structural part.

Inputs:

I1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I2 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I3 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies

I4 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I5 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I6 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

Controls:

(None)

Outputs:

01 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- Refined ACSP Analyses
  All analysis output data from Detail Analysis including:
  - Deflections
    The displacements of the nodes of the finite element model that result from a finite element analysis.
  - Failure Location/Mode
    The location and mode of failure around a fastener hole in a joint analysis.
  - Margins of Safety
    A ratio of actual to allowable stress or strain. A ratio greater than one means that the value of stress or strain will meet the design criteria.
  - Ply Percentages/Orientations
    The orientations of the plies in an ACSP, and the associated percentages of the total thickness.
  - Required Thickness/Minimum Gage

Either the required thickness or the minimum gage to meet the margin of safety criteria.

- Secondary Loads
  The loads applied to a panel resulting to response to out of plane structural response.

- Stiffener Runout
  The twisting of a TCA due to deflection under load.

- Stress/Strain Data
  The stress and strain data from stiffener pull-off analyses and tests.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

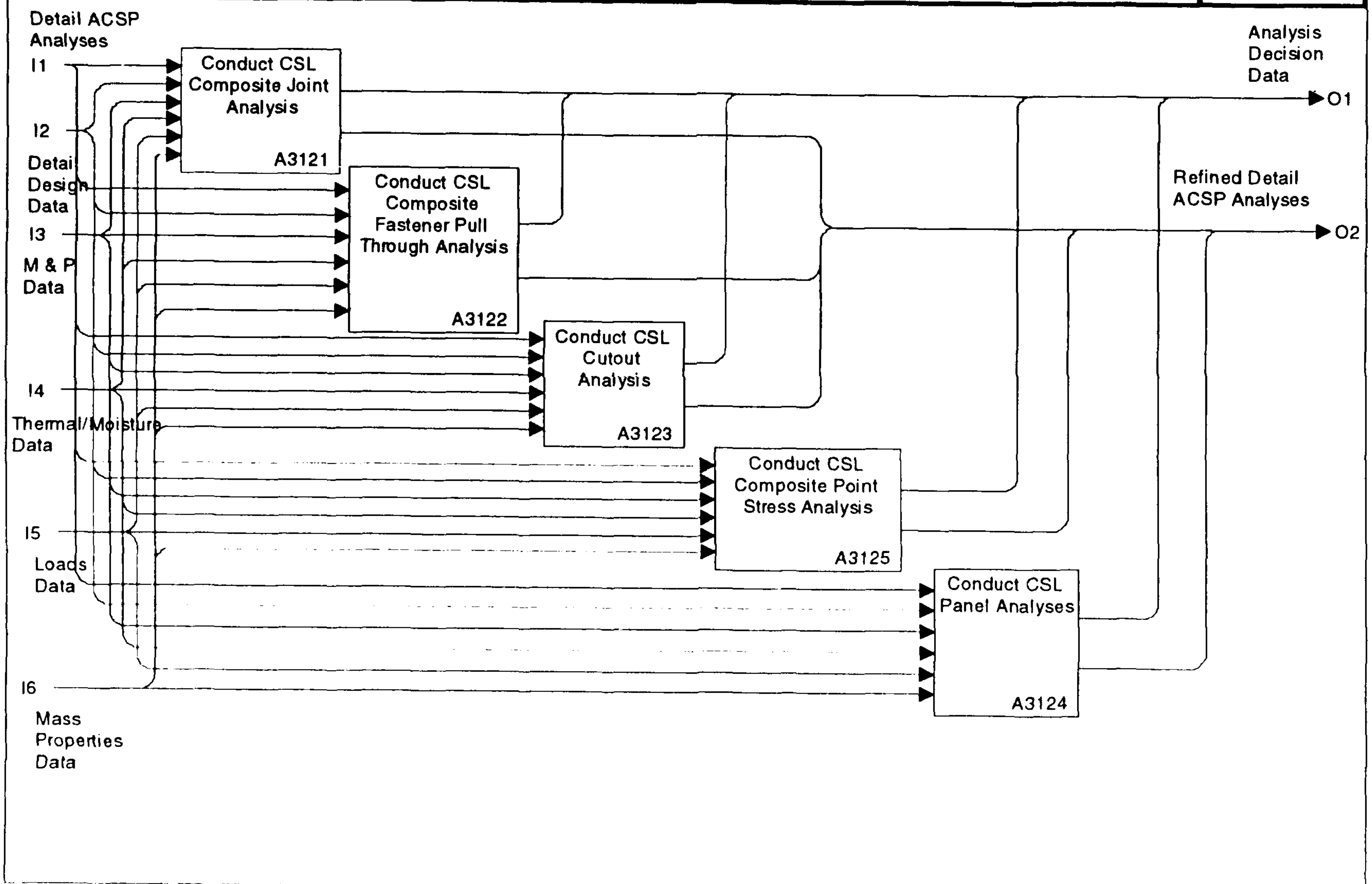
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING X DRAFT	RECOMMENDED PUBLICATION	CONTEXT:
	NODE: A312	TITLE: Conduct CSL Static Strength Analysis			



30؟

A-312: Conduct CSL Static Strength Analyses

Activities:

A3121 **Conduct CSL Composite Joint Analyses**
Conduct joint analyses to augment the finite element analyses of the structural part.

A3122 **Conduct CSL Composite Fastener Pull-Through Analyses**
Conduct fastener pull through analyses to augment the finite element analyses of the structural part.

A3123 **Conduct CSL Composite Cutout Analyses**
Conduct cutout analyses to augment the finite element analyses of the structural part.

A3124 **Conduct CSL Composite Point Stress Analysis**
Conduct point stress analyses to augment the finite element analyses of the structural part.

A3125 **Conduct CSL Panel Analyses**
Conduct panel analyses such as buckling, crippling, transverse loadings, and panel flutter to augment the finite element analyses of the structural part.

Inputs:

I1 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I2 **Detail Design Data**
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I3 **M & P Data**
All of the data needed to describe the physical responses of a composite material or its plies.

I4 **Thermal/Moisture Data**
The thermal and moisture environment of the ACSP.

I5 **Loads Data**
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I6 **Mass Properties Data**
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

Controls:

(None)

Outputs:

01 **Detail ACSP Analyses**
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- **Refined ACSP Analyses**
  All analysis output data from Detail Analysis including:
  - Deflections
    The displacements of the nodes of the finite element model that result from a finite element analysis.
  - Failure Location/Mode
    The location and mode of failure around a fastener hole in a joint analysis.
  - Margins of Safety
    A ratio of actual to allowable stress or strain. A ratio greater than one means that the value of stress or strain will meet the design criteria.
  - Ply Percentages/Orientations
    The orientations of the plies in an ACSP, and the associated percentages of the total thickness.
  - Required Thickness/Minimum Gage
    Either the required thickness or the minimum gage to meet the margin of safety criteria.

- Secondary Loads
  The loads applied to a panel resulting to response to out of plane structural response.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

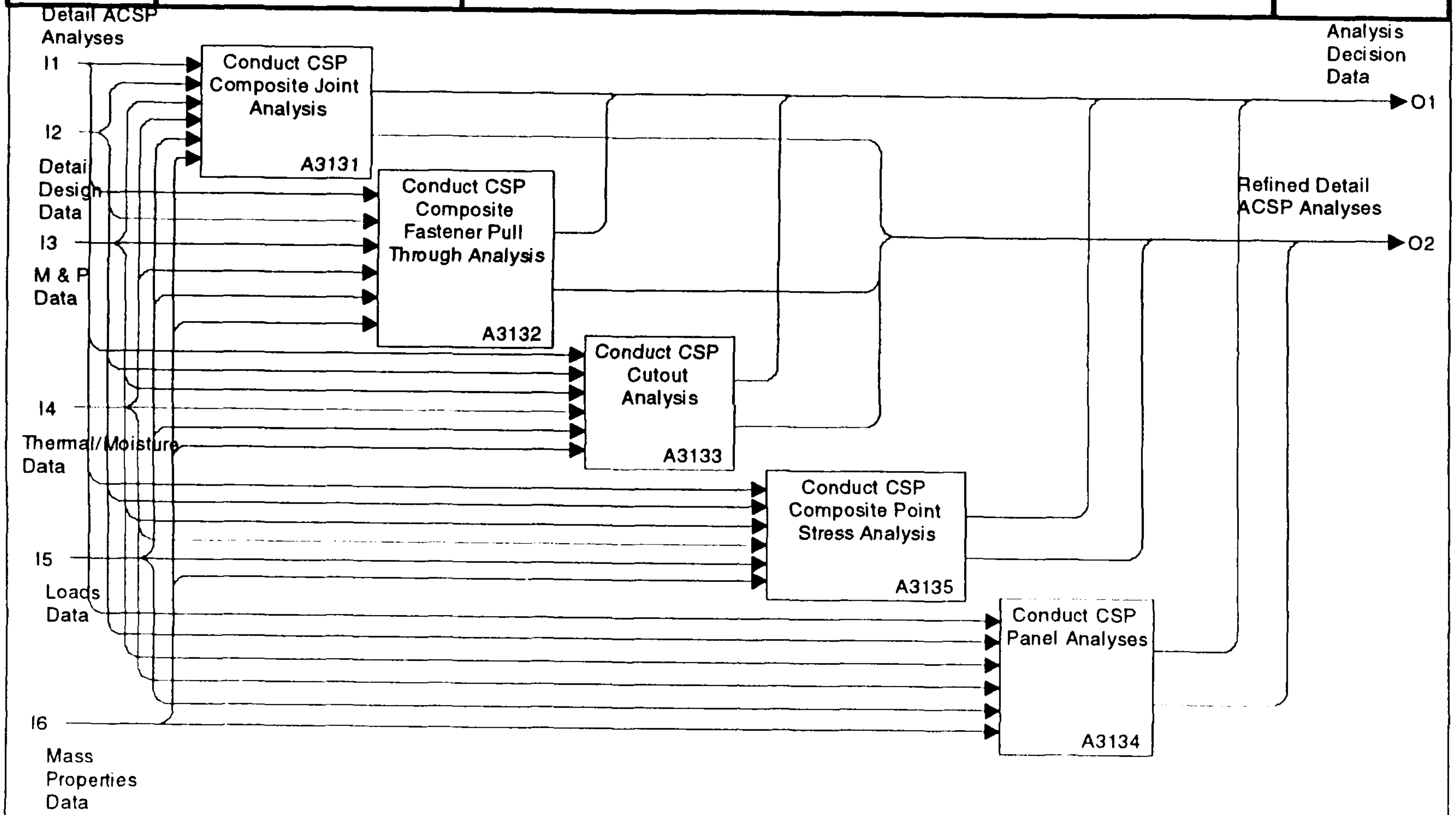
Mechanisms:

(None)

Process Interactions:

(None)

USED AT: LTV, GD & Boeing	AUTHOR: PAS-C Team & Experts PROJECT: PAS-C	DATE: 12/16/91 REV: 00	WORKING / X DRAFT / RECOMMENDED / PUBLICATION / CONTEXT:
	NODE: A313	TITLE: Conduct CSP Static Strength Analysis	



A-313: Conduct CSP Static Strength Analyses

Activities:

A3131 Conduct CSP Composite Joint Analyses
Conduct joint analyses to augment the finite element analyses of the structural part.

A3132 Conduct CSP Composite Fastener Pull-Through Analyses
Conduct fastener pull through analyses to augment the finite element analyses of the structural part.

A3133 Conduct CSP Composite Cutout Analyses
Conduct cutout analyses to augment the finite element analyses of the structural part.

A3134 Conduct CSP Composite Point Stress Analysis
Conduct point stress analyses to augment the finite element analyses of the structural part.

A3135 Conduct CSP Panel Analyses
Conduct panel analyses such as buckling, crippling, transverse loadings, and panel flutter to augment the finite element analyses of the structural part.

Inputs:

I1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

I2 Detail Design Data
The design geometry and associated ply boundaries, orientations, properties and stacking sequences of the ACSP.

I3 M & P Data
All of the data needed to describe the physical responses of a composite material or its plies.

I4 Thermal/Moisture Data
The thermal and moisture environment of the ACSP.

I5 Loads Data
The applied forces, moments, displacements and rotations that are applied to a finite element model in combination with boundary constraints and releases to form input to a finite element analysis.

I6 Mass Properties Data
The mass data of the ACSP. This data contains both overall structural mass data and lumped mass data to represent non-structural mass, discretized at the nodes of the finite element model.

Controls:

(None)

Outputs:

O1 Detail ACSP Analyses
All analysis output data from finite element, detail, and DADTA analyses, and the documentation of the decisions taken during those analyses.

- Refined ACSP Analyses
  All analysis output data from Detail Analysis including:
  - Deflections
    The displacements of the nodes of the finite element model that result from a finite element analysis.
  - Failure Location/Mode
    The location and mode of failure around a fastener hole in a joint analysis.
  - Margins of Safety
    A ratio of actual to allowable stress or strain. A ratio greater than one means that the value of stress or strain will meet the design criteria.
  - Ply Percentages/Orientations
    The orientations of the plies in an ACSP, and the associated percentages of the total thickness.
  - Required Thickness/Minimum Gage
    Either the required thickness or the minimum gage to meet the margin of safety criteria.

- Secondary Loads
  The loads applied to a panel resulting to response to out of plane structural response.

O2 Analysis Decision Data
The data that records the decisions and idealizations made during the stress analysis of the ACSP.

Mechanisms:

(None)

Process Interactions:

(None)

2.4 Building-Block Specific Information Needs

This section contains the tables used to capture the information needs for each Building-Block. The information needs in Table 2 presented in section 2.4.1. documents the characteristics for each functional view, their definitions, and their associated informational aspects (function, material, shape, process). Table 3 presented in section 2.4.2, documents a cross reference between Characteristics and Functional Views. Section 2.4.3 presents a summary of the PAS-C information needs and an assessment of need priorities.

The Characteristic Definition table is a record of what characteristics there are for each Composite Item considered by a particular View. The definition particular to that view is documented. Finally the type of information aspects that apply to each Characteristic is recorded. The definitions and aspects of the characteristics are then referred to by table 3.

The Characteristic versus View cross reference matrix presented in the table in section 2.4.2 records which views share common characteristics. The definition and aspects of shared characteristics are different for each view. The documentation of these differences provide the foundation for integration of characteristics and their aspects.

The characteristics identified were the result of a brainstorming session with composite experts. The resulting terminology and definitions of the characteristics are directly from the experts. Because of this inconsistences between some of the identified characteristics and the established FW/BB terminology exist. These inconsistences will be resolved in the next step of Phase I of the PAS-C Program.

The information needs summaries are presented by view, and then the views assessed as to the payback from utilizing PAS-C technology. The characteristics are prioritized by assessing the number of referencing composite items.

The next step will be the creation of two more tables to record the Internal and External interrelationships between the Characteristics and the constraints between them. The four Characteristic tables will provide a solid basis for information and relationship integration. The integrated information and relationships based upon the four tables will provide a sound foundation for the information models that will comprise the majority of the Application Protocols to be created in Phase II of the PAS-C Program.

2.4.1 Characteristics Descriptions

This section considers the information for each View needed to describe Composite Items. The Characteristics that a particular View requires to describe a Composite Item are listed, along with associated definitions and an assessment of the Characteristic's Aspects (function, material, shape or process).

Table 2 Characteristic Definitions and Aspects

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
DETAIL DESIGN (DD) - FILAMENT ASSEMBLY (FABRIC)		
Material Name/Description	A woven material that primarily includes graphite, fiberglass, aramid fibers with or without different pre-preg matrices (epoxies).	M
Material Thickness	The cured fabric thickness per ply.	S
Fiber Orientation	The greater amount of either the 0° or 90° fiber direction in a weave.	S
Fiber/Resin Ratio	The volume percentage of fiber to resin in a fabric.	M,F
Mechanical Material Properties	The basic ply's load carrying properties in a cured state, which is fiber material dependent in both 0° or 90° vector.	F
Warp/Fill Directions	See fiber orientation.	S
Warp/Fill Percentages	The ratio of 0° or 90° in the weave.	S,M
Weave	The different types of braiding in the fabric.	P,M
Material Stock Size	The width and length of the raw fabric stock.	M,S
DETAIL DESIGN (DD) - FILAMENT ASSEMBLY (UNIDIRECTIONAL TAPE)		
Material Name/Description	A unidirectional material that primarily includes graphite, fiberglass, aramid fiber with or without different pre-preg matrices (epoxies).	M
Material Thickness	The cured unidirectional thickness.	S
Fiber/Resin Ratio	The volume percentage of fiber to resin in tape.	M,S

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Mechanical Material Properties	The unidirectional ply's load carrying properties in a cured stated, which is fiber material dependent.	F
Material Stock Size	The width of the tape as supplied by the vendor.	S,M
DETAIL DESIGN (DD) - FILAMENT ASSEMBLY (FILLER)		
Material Name/Description	The graphite or fiberglass unidirectional fiber with or without different pre-preg matrices.	M
Mechanical Material Properties	See Unidirectional.	F
Fiber/Resin Ratio	The volume percentage of fiber to resin.	S
Material Stock Size	The random size of the fiber arrangement as supplied by the vendor.	S
DETAIL DESIGN (DD) - PLY Piece		
Filament Assembly Characteristics	The tape & fabric characteristics as described in more detail in the Filament Assembly section.	ALL
Boundary	The end of ply detail plan view of either a flat or lofted surface.	S
Flat Pattern	This the end of ply of an unfolded boundary.	S
Fiber Orientation	Direction of the primary load carrying filaments.	S
Ply Detail Identification	When ply detail equals one (1) then the ply detail identification is the ply number.	S
DETAIL DESIGN (DD) - PLY		
Ply Detail Characteristics	The ply detail characteristics as described in the prior section.	ALL
Boundary	The end of ply plan view of either a flat or lofted surface.	S
Ply Identification	The assigned ply number.	S
Ply Detail Interface	Where the ply details (EOP) meet in either a butt, overlap or gap orientation.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect**[1]
Ply Detail Location	The relative location of the ply details in relationship to each other in the plan view.	S
Number of Ply Details	The number of ply details in a ply and when the ply detail equals one (1) it is a ply.	S
DETAIL DESIGN (DD) - PLY LAMINATE - GENERAL FLAT		
Envelope	The envelope of the part in the XYZ planes.	S
Laminate Thickness	The dimension of the ply set-up.	S
Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	S
Fastener Holes & Cut Outs	The removed portions of the laminate part.	S
Ply Characteristics	The ply characteristics as described in the prior section.	ALL
Ply Stack	A subset of ply table consisting of sequence and location.	ALL
Ply Table	A matrix of the laminate characteristics.	ALL
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Ply Transition	The drop off of plies in the laminate.	F
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Strength	The capacity to carry loads.	F
Weight	The density characteristic times the volume of the part.	F
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	S
Laminate Properties	The combined mechanical properties of the laminate.	F
Laminate Symmetry	The balancing of the ply orientations with respect to the neutral axis.	S
Laminate Assembly Process	The sequence of assembling the laminate in the shop.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Filler Plies	Plies added to meet the design tolerances.	S
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	F
DETAIL DESIGN (DD) - PLY LAMINATE - CONTOURED SKIN LAMINATE (CSL) GENERAL CONTOURED WRAPPABLE		
Envelope	The envelope of the part in the XYZ planes.	S
Laminate Thickness	The dimension of the ply set-up.	S
Contoured Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	F
Fastener Holes & Cut Outs	The removed portions of the laminate part.	S
Ply Characteristics	The ply characteristics as described in the prior section.	ALL
Ply Stack	A subset of ply table consisting of sequence and location.	S
Ply Table	A matrix of the laminate characteristics.	ALL
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Ply Transition	The drop off of plies in the laminate.	F
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Strength	The capacity to carry loads.	F
Weight	The density characteristic times the volume of the past.	F
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	S
Laminate Properties	The combined mechanical properties of the laminate.	F
Laminate Symmetry	The balancing of the ply orientations with respect to the neutral axis.	F

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Laminate Assembly Process	The sequence of assembling the laminate in the shop.	P
Filler Plies	Plies added to meet the design tolerances.	S
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	F
DETAIL DESIGN (DD) - PLY LAMINATE - ANGLE		
Envelope	The envelope of the part in the XYZ planes.	S
Laminate Thickness	The dimension of the ply set-up.	S
Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	F
Fastener Holes & Cut Outs	The removed portions of the laminate part.	S
Ply Characteristics	The ply characteristics as described in the prior section.	ALL
Ply Stack	Ply stack is a subset of ply table consisting of sequence and location.	S
Ply Table	A matrix of the laminate characteristics.	ALL
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Ply Transition	The drop off of plies in the laminate.	F
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Strength	The capacity to carry loads.	F
Weight	The density characteristic times the volume of the past.	W
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	S
Laminate Properties	The combined mechanical properties of the laminate.	F
Cross-Section Properties	The mechanical properties of the cross-sectional area.	F

1 Aspect Codes: F-Function M-Matenal S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect[1]**
Angle Location	The Angle location relative to the position in the assembly.	S
Laminate Symmetry	The balancing of the ply orientations with respect to the neutral axis.	S
Laminate Assembly Process	The sequence of assembling the laminate in the shop.	P
Filler Plies	Plies added to meet the design tolerances.	S
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	F
Detail Design (DD) - Ply Laminate - Cap		
Boundary	The outline of a ply laminate plan view of either a flat or lofted surface.	S
Laminate Thickness	The dimension of the ply set-up.	S
OML/IML Surface	The outer mold line and either mold line surface of the cap.	F
Joints/Interfaces	The removed portions of the laminate part.	S
Ply Stack	Ply stack is a subset of ply table consisting of sequence and location.	S
Ply Table	A matrix of the laminate characteristics.	ALL
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Ply Drop Off	The drop off of plies in the laminate.	F
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Strength	The capacity to carry loads.	F
Weight	The density characteristic times the volume of the past.	F
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect**[1]
Laminate Properties	The combined mechanical properties of the laminate.	F
Cross-Section Properties	The mechanical properties of the cross-sectional area.	F
Cap Location	The Cap location relative to the position in the assembly.	S
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	F
DETAIL DESIGN (DD) - CORE - STOCK MATERIAL		
Material Name	A ribbon or foam oriented material that primarily includes fiberglass, phenolic and metals.	M
Material Thickness	This is thickness parallel to the cell direction as supplied by the vendor.	S
Ribbon Direction	The direction of continuous ribbon.	F
Core Density	The weight per unit volume.	F
Mechanical Material Properties	The load carrying properties.	F
Material Stock Size	The thickness, width and length of the core as supplied by the vendor.	S
Core Stock Characteristics	The characteristics of the core as described in more detail in the previous section.	ALL
Envelope	The envelope of the part in the XYZ planes.	S
Flat Pattern	The edge of core of an unfolded envelope.	S
Core Detail Identification	When core detail equals one (1) then the ply detail identification is the ply number.	S
Ramp Angle	The chamfered angle of the core edge.	S
Core Detail Thickness	The height of the core at any given location.	S
Core Detail Characteristics	The characteristics as described in more detail in the previous section.	ALL

1 Aspect Codes: F-Function M-Material S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect[1]**
Detail Design (DD) - Core - Machined		
Core Detail Characteristics	The characteristics as described in more detail in the previous section.	ALL
Envelope	The envelope of the part in the XYZ planes.	S
Ramp Angle	The chamfered angle of the core edge.	S
Core Splice	The core detail interface.	S
Core Thickness	The height of the core at any given location.	S
Core Holes & Cut Outs	The removed portions of the core.	S
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Combined Mechanical Material Properties	The combined load carrying properties.	F
Detail Design (DD) - Core - Formed		
Boundary/Envelope	The boundary/envelope of the part in the XYZ planes.	S
Ramp Angle	The chamfered angle of the core edge.	S
Core Splice	The core detail interface.	S
Core Density	The weight per unit volume.	F
Core Thickness	The height of the core at any given location.	S
Joints/Interfaces	The removed portions of the laminate part.	S
Ribbon Direction	The direction of continuous ribbon.	F
Material Name	A ribbon or foam oriented material that primarily includes gloss phenolic and metals.	M
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Panel Size	The length and width of the panel within the next assembly.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Mechanical Material Properties	The combined load carrying properties.	F
OML/IML Surface	The laminate surface in contact with mold or bag.	F
DETAIL DESIGN (DD) - CORE - STABILIZED		
Boundary/Envelope	The boundary/envelope of the part in the XYZ planes.	S
Ramp Angle	The chamfered angle of the core edge.	S
Core Splice	The core detail interface.	S
Core Density	The weight per unit volume.	F
Core Thickness	The height of the core at any given location.	S
Joints/Interfaces	The removed portions of the laminate part.	S
Ribbon Direction	The direction of continuous ribbon.	F
Material Name	A ribbon or foam oriented material that primarily includes fiberglass, phenolic and metals.	M
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Panel Size	The length and width of panel within the next assembly.	S
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Mechanical Material Properties	The combined load carrying properties.	F
Stabilizer	An injected material to and in support of the core ribbon.	F
DETAIL DESIGN (DD) - COMPOSITE ASSEMBLY CORE STIFFENED PANEL (CSP) - CORE/PLY LAMINATE/PLY LAMINATE		

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Core Characteristics	The characteristics as described in more detail in the core section.	ALL
Ply Laminate Characteristics	These are characteristics as described in more detail in the laminate section.	ALL
Adhesive (type)	A bonding agent between the core and the laminate. Note: This includes an X-ply for smoothing.	P
Fastener Holes & Cut Outs	The removed portions of the core.	S
Ply Table	A matrix of the Assembly characteristics	ALL
Envelope	The envelope of the part in the XYZ planes.	S
Thickness	The combined sandwich thickness.	S
Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	F
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Panel Size	The length and width of panel within the next assembly.	S
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Strength	The capacity to carry loads.	F
Weight	The density characteristic times the volume of the past.	F
Core Stiffened Panel Assembly Process	The sequence of assembling the laminate and the core in the core assembly.	P
Filler Characteristics	These are characteristics as described in more detail in the Filler section.	ALL
Assembly Symmetry	The balancing of the ply orientations with respect to the neutral axis.	S
Next Assembly Information	These are necessary characteristics of adjoining parts. Reference information only.	F
DETAIL DESIGN (DD) - "T" COMPOSITE ASSEMBLY (TCA) - LD (ANGLE)/LD (ANGLE)/FILAMENT LAMINATE (FILLER)/LD (CAP)		

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Ply Laminate (Angle) Characteristics	These are characteristics as described in more detail in the Angle section.	ALL
Laminate Detail (Filler) Characteristics	These are characteristics as described in more detail in the Filler section.	ALL
Ply Laminate (Cap) Characteristics	These are characteristics as described in more detail in the Cap section.	ALL
Joints/Interfaces	The removed portions of the laminate part.	S
Panel Size	The length and width of panel within the next assembly.	S
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	F
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	F
Strength	The capacity to carry loads.	F
Weight	The density characteristic times the volume of the past.	F
DETAIL STRUCTURAL ANALYSIS - FILAMENT ASSEMBLY (FABRIC)		
Material Name/Description	The name of the material system and a description including the following: warp and fill fibers, resin, manufacturer(s), tow size, toughened/untoughened, thermoset/thermoplastic, applicable specifications.	M
Material Thickness	Nominal theoretical thickness of the Filament Assembly (Fabric) when cured in a laminate that corresponds to fiber volume and resin content.	M, S
Reference Orientation	The basic orientation direction of the fabric relative to an established coordinate system.	M, S
Warp/Fill Directions	The warp and fill directions with respect to the reference orientation. The warp direction is established by the fibers that are oriented longitudinally in the fabric, fill are the fibers that cross the warp fibers.	M, S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect**[1]
Warp/Fill Percentages	The percentage of fiber in the warp and fill directions. The percentages are assumed to add to 100%.	M, S
Fiber Volume	Percentage of the total laminate volume composed of fibers.	M
Resin Content	Percentage of the total material weight composed of resin.	M

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Mechanical Material Properties	The mechanical properties of the Filament Assembly (Fabric) including: Density Warp Youngs Modulus - Compression Fill Youngs Modulus - Compression Warp Youngs Modulus - Tension Fill Youngs Modulus - Tension Through the Thickness Youngs Modulus (33) Poisson's Ratio (12, 23, 13) Shear Modulus (12, 23, 13) Warp Thermal Coefficient Fill Thermal Coefficient Through the Thickness Thermal Coefficient (33) Shear Thermal Coefficient (12,23, 13) Warp Moisture Absorption Coefficient Fill Moisture Absorption Coefficient Through the Thickness Moisture Absorption Coefficient (33) Strain Allowables Warp Compressive Fill Compressive Through the Thickness Compressive (33) Warp Tensile Fill Tensile Through the Thickness Tensile (33) Positive Shear (12, 23, 13) Negative Shear (12, 23, 13) Stress Allowables Warp Compressive Fill Compressive Through the Thickness Compressive (33) Warp Tensile Fill Tensile Through the Thickness Tensile (33) Shear (12, 23, 13) Characteristic Dimension for Tension (Fastener Analysis) Characteristic Dimension for Compression (Fastener Analysis) Miscellaneous Properties	M, S
Weave	Style of weaving used to form the fabric. Some examples include: five harness stain, crows foot, twill.	M, S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Finish	The sizing put on the tows prior to weaving and resin impregnation.	M
DETAIL STRUCTURAL ANALYSIS - FILAMENT ASSEMBLY (TAPE)		
Material Name/Description	The name of the material system and a description including the following: fibers, resin, manufacturer(s), tow size, toughened/untoughened, thermoset/thermoplastic. applicable specifications.	M
Material Thickness	Nominal theoretical thickness of the Filament Assembly (Tape) when cured in a laminate that corresponds to fiber volume and resin content.	M, S
Fiber Volume	Percentage of the total laminate volume composed of fibers.	M
Resin Content	Percentage of the total material weight composed of resin.	M

1 Aspect Codes. F-Function M-Material S-Shape P-Process

Characteristic	Description	Aspect[1]
VIEW - COMPOSITE ITEM		
Mechanical Material Properties	The mechanical properties of the Filament Assembly including: Density Youngs Modulus - Compression (11, 22, 33) Youngs Modulus - Tension (11, 22, 33) Poisson's Ratio (12, 23, 13) Shear Modulus (12, 23, 13) Thermal Coefficient (11, 22) Through the Thickness Thermal Coefficient (33) Shear Thermal Coefficient (12, 23, 13) Moisture Absorption Coefficient (11, 22) Strain Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Positive Shear (12, 23, 13) Negative Shear (12, 23, 13) Stress Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Shear (12, 23, 13) Characteristic Dimension for Tension (Fastener Analysis) Characteristic Dimension for Compression (Fastener Analysis) Miscellaneous Properties	M, S
DETAIL STRUCTURAL ANALYSIS - FILAMENT ASSEMBLY (FILLER)		
Material Name/Description	The name of the material system and a description including the following: fibers, resin manufacturer(s), tow size, toughened/untoughened, thermoset/thermoplastic, grade and type callouts for adhesive (if present), applicable specifications. Material Thickness	M
Fiber Volume	Percentage of the total laminate volume composed of fibers.	M
Resin Content	Percentage of the total material weight composed of resin.	M

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Mechanical Material Properties	The mechanical properties of the Filament Assembly (Filler) including: Density Youngs Modulus - Compression (11, 22, 33) Youngs Modulus - Tension (11, 22, 33) Poisson's Ratio (12, 23, 13) Shear Modulus (12, 23, 13) Thermal Coefficient (11, 22) Through the Thickness Thermal Coefficient (33) Shear Thermal Coefficient (12, 23, 13) Moisture Absorption Coefficient (11, 22) Strain Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Positive Shear (12, 23, 13) Negative Shear (12, 23, 13) Stress Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Shear (12, 23, 13) Characteristic Dimension for Tension (Fastener Analysis) Characteristic Dimension for Compression (Fastener Analysis) Miscellaneous Properties	M, S
Shape	The cross-sectional geometry of the filler if it is preformed.	M, S
DETAIL STRUCTURAL ANALYSIS - PLY PIECE		
Boundary	The location of the outer contiguous perimeter of a Ply Detail.	S
Reference Orientation	The basic orientation direction of the Ply Detail relative to an established coordinate system.	S
Ply it is a part of	Reference to the ply that the Ply Detail is a part of.	S
Filament Assembly Characteristics	A reference to a Filament Assembly, including all the characteristics of that Filament Assembly.	M, S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
OML/IML Surface	The surfaces that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the Ply Detail.	S
Ply Detail Normal	A normal to the OML or IML surface of the Ply Detail positive in the direction of ascending Ply Sequence Number.	S
Warp Surface	The side of the woven fabric where the material is composed of yarns running lengthwise to the fabric.	S
Fill Surface	The side of the woven fabric where the majority of the visible weave is composed of yarns running in the width of the fabric.	S
DETAIL STRUCTURAL ANALYSIS - PLY		
Boundary	The location of the outer contiguous perimeter of a Ply.	S
Reference Orientation	The basic orientation direction of the Ply relative to an established coordinate system.	S
Ply Detail Characteristics	A reference to a list of Ply Details including all the characteristics of the member Ply Detail(s).	M, S
Ply Sequence Number	The Ply Sequence Number is the order in which the Plies are laid down on the tool. The first Ply laid down is ply number 1, and the remaining Plies are assigned sequence numbers in ascending order.	M, S
OML/IML Surface	The surfaces that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the Ply.	S
Ply Normal	A normal to the OML or IML surface of the Ply Detail positive in the direction of ascending Ply Sequence Number.	S
DETAIL STRUCTURAL ANALYSIS - PLY LAMINATE (GENERAL FLAT)		
Boundary	The location of the outer contiguous flat perimeter of a General Flat Ply Laminate.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect[1]**
Laminate Thickness(es)	The theoretical cured laminate thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
OML/IML Surface	The surface that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Flat Ply Laminate.	S
Ply Table	A list of references of the constituent Plies and all their characteristics and associated Ply Sequence Numbers.	M, S
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a General Flat Ply Laminate.	?
Weight	The weight of the General Flat Ply Laminate.	S
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Flat Ply Laminate.	M, S
Stack Normal	A normal to the OML or IML surface of the General Flat Ply Laminate, positive on the direction of ascending Ply Sequence Number.	S
Reference Orientation	The basic orientation direction of the General Flat Ply Laminate relative to an established coordinate system.	S
Detail Structural Analysis - Ply Laminate (General Contour/Wrappable)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Contour/Wrappable Ply Laminate.	S
Ply Table	A list of references of the constituent Plies and all their characteristics and associated Ply Sequence Numbers.	M, S
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a General Contour/Wrappable Ply Laminate.	?
Weight	The weight of the General Contour/Wrappable Ply Laminate.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Contour/Wrappable Ply Laminate.	M, S
Stack Normal	A normal to the OML or IML surface of the General Contour/Wrappable Ply Laminate, positive on the direction of ascending Ply Sequence Number.	S
Reference Orientation	The basic orientation direction of the General Contour/Wrappable Ply Laminate relative to an established coordinate system.	S
DETAIL STRUCTURAL ANALYSIS - PLY LAMINATE (ANGLE AND CAP)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of an Angle/Cap Ply Laminate.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of an Angle/Cap Ply Laminate.	S
Ply Table	A list of references of the constituent Plies and all their characteristics and associated Ply Sequence Numbers.	M, S
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of an Angle Ply Laminate.	?
Weight	The weight of the General Contour/Wrappable Ply Laminate.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Cross Section Properties	The beam bending properties of the Angle cross section (moments of inertia, etc.)	S
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of an Angle/Cap Ply Laminate.	M, S
Reference Orientation	The basic orientation direction of the Angle/Cap Ply Laminate relative to an established coordinate system.	S
DETAIL STRUCTURAL ANALYSIS - CORE DETAIL		
Material Name/Description	The name of the material system and a description including the following: fibers, resin, manufacturer(s), toughened/untoughened, thermoset/thermoplastic/metal, applicable specifications.	M

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter surface of a Core Detail.	S
Ramp Angle	The angle of the boundary envelope surface where it intersects the Core Detail Top or Bottom Surface.	S
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Ribbon Direction	The continuous Ribbon Direction of the Core Detail.	M, S
Cell Size	The size of the honeycomb cells of the Core Detail.	M, S
Weight	The weight of the Core Detail.	M
Material Properties	The mechanical Material Properties of the Core Detail.	M, S
Core Normal	A direction normal to the Top Surface of the Core Detail positive from the Bottom Surface to the Top Surface.	S
Top Surface	The surface that the Core Normal is defined with respect to.	S
Bottom Surface.	The surface located on the negative core normal direction from the top surface.	S
DETAIL STRUCTURAL ANALYSIS - CORE ASSEMBLY		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter surface of a Core Assembly.	S
Core Detail Characteristics	A reference to a list of Core Details including all the characteristics of the member Core Details.	M, S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Reference Orientation	The basic orientation direction of the Core Assembly relative to an established coordinate system.	S
Assembly List	A list specifying the assembly of the constituent Core Details. Core Detail coordinate systems are assembled with respect to the Core Assembly Reference Orientation.	S
DETAIL STRUCTURAL ANALYSIS - COMPOSITE LAYUP ASSEMBLY (CORE ASSEMBLY/PLY LAMINATE (FLAT)/PLY LAMINATE)		
Core Assembly Characteristics	A reference to a Core Assembly including all the characteristics of the Core Assembly.	M, S
Ply Laminates Characteristics	A reference to two Ply Laminates (also known as face sheets) including all the characteristics of the Ply Laminates.	M. S
Adhesive (type)	The adhesive used to bond the face sheets to the Core Assembly.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	S
OML/IML Surfaces	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of a bond tool surface of a Composite Assembly.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a Composite Assembly.	?
Weight	The weight of the Composite Assembly.	M
Combined Material Properties	The smeared (equivalent) mechanical Material Properties of the Composite Assembly.	M, S
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	S
Reference Normal	A direction normal to the top surface of the Core Assembly bond mold surface positive in the part direction from the surface.	S
Assembly List	A list specifying the assembly of the face sheets and Core Assembly. Core Detail and face sheet coordinate systems are assembled with respect to the Core Assembly Reference Orientation.	S
DETAIL STRUCTURAL ANALYSIS - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (ANGLE) / PLY LAMINATE (ANGLE) / FILAMENT DETAIL (FILLER)/ PLY LAMINATE (CAP))		
Ply Laminate (Angle) Characteristics	A reference to two Ply Laminates (Angle) including all the characteristics of the Ply Laminates.	M, S
Filament Assembly (Filler) Characteristics	A reference to a Filament Detail (Filler) including all the characteristics of the Filament Detail.	M, S
Ply Laminate (Cap) Characteristics	A reference to a Ply Laminate (Cap) including all the characteristics of the Ply Laminate.	M, S
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Cross Section Properties	The beam bending properties of the Composite Assembly cross section (moments of inertia, etc.)	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect[1]**
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a Composite Assembly.	?
Weight	The weight of the Composite Assembly.	M
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	S
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	S
Assembly List	A list specifying the assembly of the two angles, filler and cap into a Composite assemble Assembly. Angle, filler and cap coordinate systems are assembled with respect to the Core Assembly Reference Orientation.	S
Preliminary Structural Analysis - Ply Laminate (General Flat)		
Boundary	The location of the outer contiguous flat perimeter of a General Flat Ply Laminate.	S
Laminate Thickness(es)	The theoretical cured laminate thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
OML/IML Surface	The surface that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Flat Ply Laminate.	S
Ply Orientations	A list of ply orientations defined with respect to the reference orientation. Note that this information is combined with the Ply Percentages to provide a complete laminate description.	M, S
Ply Percentages	The percentage of total theoretical laminate thickness in each ply orientation.	M, S
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	?
Weight	The weight of the General Flat Ply Laminate.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Flat Ply Laminate.	M, S
Stack Normal	A normal to the OML or IML surface of the General Flat Ply Laminate, positive on the direction of ascending Ply Sequence Number.	S
Reference Orientation	The basic orientation direction of the General Flat Ply Laminate relative to an established coordinate system.	S
PRELIMINARY STRUCTURAL ANALYSIS - PLY LAMINATE (GENERAL CONTOUR/WRAPPABLE)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	S
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Contour/Wrappable Ply Laminate.	S
Ply Orientations	A list of ply orientations defined with respect to the reference orientation. Note that this information is combined with the Ply Percentages to provide a complete laminate description.	M, S
Ply Percentages	The percentage of total theoretical laminate thickness in each ply orientation.	
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	?

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect**[1]
Weight	The weight of the General Contour/Wrappable Ply Laminate.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Contour/Wrappable Ply Laminate.	M, S
Stack Normal	A normal to the OML or IML surface of the General Contour/Wrappable Ply Laminate, positive on the direction of ascending Ply Sequence Number.	S
Reference Orientation	The basic orientation direction of the General Contour/Wrappable Ply Laminate relative to an established coordinate system.	S
PRELIMINARY STRUCTURAL ANALYSIS - PLY LAMINATE (ANGLE AND CAP)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of an Angle/Cap Ply Laminate.	S
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of an Angle/Cap Ply Laminate.	S
Ply Orientations	A list of ply orientations defined with respect to the reference orientation. Note that this information is combined with the Ply Percentages to provide a complete laminate description.	M, S
Ply Percentages	The percentage of total theoretical laminate thickness in each ply orientation.	

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	?
Weight	The weight of the General Contour/Wrappable Ply Laminate.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Cross Section Properties	The beam bending properties of the Angle cross section (moments of inertia, etc.)	S
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of an Angle/Cap Ply Laminate.	M, S
Reference Orientation	The basic orientation direction of the Angle/Cap Ply Laminate relative to an established coordinate system.	S
PRELIMINARY STRUCTURAL ANALYSIS - CORE DETAIL		
Material Name/Description	The name of the material system and a description including the following: fibers, resin, manufacturer(s), toughened/untoughened, thermoset/thermoplastic/metal, applicable specifications.	M
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter surface of a Core Detail.	S
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load. May or may not require Next Assembly information.	S
Ribbon Direction	The continuous Ribbon Direction of the Core Detail.	M, S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Weight	The weight of the Core Detail.	M
Material Properties	The mechanical Material Properties of the Core Detail.	M, S
Core Normal	A direction normal to the Top Surface of the Core Detail positive from the Bottom Surface to the Top Surface.	S
Top Surface	The surface that the Core Normal is defined with respect to.	S
Bottom Surface.	The surface located on the negative core normal direction from the top surface.	S
PRELIMINARY STRUCTURAL ANALYSIS - COMPOSITE LAYUP ASSEMBLY (CORE ASSEMBLY/PLY LAMINATE (FLAT)/PLY LAMINATE)		
Core Assembly Characteristics	A reference to a Core Assembly including all the characteristics of the Core Assembly.	M, S
Ply Laminates Characteristics	A reference to two Ply Laminates (also known as face sheets) including all the characteristics of the Ply Laminates.	M, S
Adhesive (type)	The adhesive used to bond the face sheets to the Core Assembly.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	S
OML/IML Surfaces	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of a bond tool surface of a Composite Assembly.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	?
Weight	The weight of the Composite Assembly.	M
Combined Material Properties	The smeared (equivalent) mechanical Material Properties of the Composite Assembly.	M, S
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	S
Reference Normal	A direction normal to the top surface of the Core Assembly bond mold surface positive in the part direction from the surface.	S
Assembly List	A list specifying the assembly of the face sheets and Core Assembly. Core Detail and face sheet coordinate systems are assembled with respect to the Core Assembly Reference Orientation.	S
PRELIMINARY STRUCTURAL ANALYSIS - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (ANGLE) / PLY LAMINATE (ANGLE) / FILAMENT DETAIL (FILLER)/ PLY LAMINATE (CAP))		
Ply Laminate (Angle) Characteristics	A reference to two Ply Laminates (Angle) including all the characteristics of the Ply Laminates.	M, S
Filament Assembly (Filler) Characteristics	A reference to a Filament Detail (Filler) including all the characteristics of the Filament Detail.	M, S
Ply Laminate (Cap) Characteristics	A reference to a Ply Laminate (Cap) including all the characteristics of the Ply Laminate.	M, S
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Cross Section Properties	The beam bending properties of the Composite Assembly cross section (moments of inertia, etc.)	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	?
Weight	The weight of the Composite Assembly.	M
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	S
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	S
Assembly List	A list specifying the assembly of the two angles, filler and cap into a Composite assemble Assembly. Angle, filler and cap coordinate systems are assembled with respect to the Core Assembly Reference Orientation.	S
STRUCTURAL TEST - PLY LAMINATE (GENERAL FLAT)		
Boundary	The location of the outer contiguous flat perimeter of a General Flat Ply Laminate.	S
Laminate Thickness(es)	The theoretical cured laminate thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
OML/IML Surface	The surface that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Flat Ply Laminate.	S
Test Results	The results of structural tests preformed on a General Flat Ply Laminate.	?
Weight	The weight of the General Flat Ply Laminate.	S
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S

1 Aspect Codes. F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Laminate Properties	The as tested mechanical Laminate Properties of the various Laminate Thicknesses of the General Flat Ply Laminate.	M, S
Reference Orientation	The basic orientation direction of the General Flat Ply Laminate relative to an established coordinate system.	S
STRUCTURAL TEST - PLY LAMINATE (GENERAL CONTOUR/WRAPPABLE)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	S
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	M, S
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Contour/Wrappable Ply Laminate.	S
Test Results	The results of structural tests preformed on a General Contour/Wrappable Ply Laminate.	?
Weight	The weight of the General Contour/Wrappable Ply Laminate.	M
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Laminate Properties	The as tested mechanical Laminate Properties of the various Laminate Thicknesses of the General Contour/Wrappable Ply Laminate.	M, S
Reference Orientation	The basic orientation direction of the General Contour/Wrappable Ply Laminate relative to an established coordinate system.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
STRUCTURAL TEST - COMPOSITE LAYUP ASSEMBLY (CORE ASSEMBLY/PLY LAMINATE (FLAT)/PLY LAMINATE)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	S
OML/IML Surfaces	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of a bond tool surface of a Composite Assembly.	S
Test Results	The results of structural tests preformed on a Composite Assembly.	?
Weight	The weight of the Composite Assembly.	M
Combined Material Properties	The as tested smeared (equivalent) mechanical Material Properties of the Composite Assembly.	M, S
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	S
STRUCTURAL TEST - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (ANGLE) / PLY LAMINATE (ANGLE) / FILAMENT DETAIL (FILLER)/ PLY LAMINATE (CAP))		
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	S
Next Assembly Information	References to the attachment of the part to adjoining parts.	S
Cross Section Properties	The as tested beam bending properties of the Composite Assembly cross section (moments of inertia, etc.)	S
Test Results	The results of structural tests preformed on a Composite Assembly.	?
Weight	The weight of the Composite Assembly.	M
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	S

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	S
MANUFACTURING PLANNING - FILAMENT ASSEMBLY (FABRIC/TAPE)		
Material Type/Description	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	P
Material Thickness	The nominal thickness of one layer of the material.	P
Weave	The manner in which the a fabric is formed by interlacing yarns in a specific pattern.	P
Drape	The ability of a material to form to a contour	P
Material Name	The manufacturer of the material and any brand name and/or product identifier.	P
Fiber/resin ratio	The ratio between the fiber content and the amount of resin present in a composite material. Determine requirements for bleeding.	P
Warp/Fill Directions	The direction of the longitudinally oriented yarn in a woven fabric./ The yarn in a fabric that crosses the warp.	P
Fiber Strength/Stiffness	The ability of the tape fibers to resist bending.	P
Material Life Data	The storage requirements, shelf life, working life, and out time limits for the materials	P
MANUFACTURING PLANNING - FILAMENT ASSEMBLY (FILLER)		
Material Name/Description	The manufacturer of the material and any brand name and/or product identifier.	P
Material Quantity	The amount (number of strands of tow) required to produce the required cross section of the filler.	P
Cross Section Volume	The volume of a cross section of the filler.	P
Boundary	The cross sectional shape and length of the filler.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Material Life Data	The storage requirements, shelf life, working life, and out time limits for the materials	P
MANUFACTURING PLANNING - PLY PIECE		
None		
MANUFACTURING PLANNING - PLY		
Boundary	The edge of the ply detail (EOP).	P
Filament Assembly Char	Inherit characteristics of Filament Assembly	
MANUFACTURING PLANNING - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	
Number of ply(ies)	How many ply(ies) make up this ply laminate.	P
Ply Table	Information on the position and orientation of each ply.	P
Boundary	The edge of the laminate.	P
Tolerances	The tolerance requirements relative to the ply laminate.	P
Splice, lap & gap	The requirements for splice location and overlapping/gaps in plies.	P
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	P
Contour	A geometric definition of the surface of the laminate (may or may not be flat). The amount of contour is defined by the deviation of the laminate from a planar surface.	P
MANUFACTURING PLANNING - CORE (MACHINED)		
Boundary	The edge of the core detail.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Core Splice	The location of the splice where the core detail will be attached to another core detail.	P
Core Thickness	The finished thickness of the core detail.	P
Core Density	The pounds per cubic foot of honeycomb core based upon the foil gauge or thickness and cell size.	P
Ramp Angle	The angle of segments of the core that are tapered.	P
Joints	The general area of contact.	P
Tolerances (thickness, location)	The degree of accuracy required when manufacturing the ACSP.	P
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb.	P
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	P
Core Configuration	The configuration of the cells (i.e., hex, flex, or over extended)	P
Mating Surface Contour	The contour (see above) of the mating surface to the core.	P
MANUFACTURING PLANNING - CORE ASSEMBLY		
Core (Machined) Characteristics	Inherit the characteristics of the machined core	
Adhesives	Identity of the adhesives that will be used to assembly the details.	P
Potting Compounds	Identity of the potting compounds that will be used.	P
Stabilizers	Identity of the stabilizers that will be used.	P
Boundary	The outside edge of the core assembly.	P
Core Detail Position	The position of the details that make up the assembly. Includes location and orientation.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect**[1]
Core Assembly Tolerances	The orientation and positional tolerances for the assembly.	P
Core Assembly Surface Contour	The relative contour of the surface of the core assembly.	P
Hard Detail Locations	The location of any hard details (fasteners, etc.) within the core assembly.	P
MANUFACTURING PLANNING - COMPOSITE LAYUP ASSEMBLY (CORE STIFFENED PANEL)		
Core Assembly Characteristics	Inherit characteristics from the core assembly.	N/A
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	P
Reference Orientation	The orientation of the core and skins relative to the tool (rosette).	P
Adhesives (type)	The type of adhesive being used and its thickness.	P
Boundary	The size and shape of the core assembly.	P
Location Tolerances	The positional accuracy required for the core assembly in the final cured ACSP.	P
MANUFACTURING PLANNING - COMPOSITE LAYUP ASSEMBLY ('T')		
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	
Reference Orientation	The orientation of the laminates and filler relative to the tool.	P
Adhesives (type)	The identify of any adhesives required in the layup and the thickness.	P
Boundary	The dimensions of the completed assembly.	P
Location Tolerances	The positional accuracy required for the completed assembly.	P
NC PROGRAMMING - FILAMENT ASSEMBLY (FABRIC/TAPE)		

1 Aspect Codes: F-Function M-Material S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect[1]**
Material Type/Description	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	P
Material Thickness	The nominal thickness of one layer of the material.	P
Material Stock Size	The form in which the material will be purchased. Such as 12" wide tape on a 120' roll. This is an output of the mfg plan.	P
Material Name	The manufacturer of the material and any brand name and/or product identifier.	P
Warp/Fill Directions	The direction of the longitudinally oriented yarn in a woven fabric./ The yarn in a fabric that crosses the warp.	P
Fiber Strength/Stiffness	The ability of the tape fibers to resist bending.	P
NC Programming - Filament Assembly (Filler)		
None		
NC Programming - Ply Piece		
Boundary	The geometric data describing the EOP.	P
Warp	The warp direction of the material.	P
Fiber Orientation	The orientation of the fabric within the ply detail.	P
Tolerance	The accuracy of the dimensions required when producing the ply detail.	P
Ply it is Part of	The identity of the parent ply.	P
NC Programming - Ply		
Boundary	The edge of the ply detail (EOP).	P
OML/IML	Identify if the ply is IML or OML.	P
Ply location in stack	The location of the ply within the stack.	P
Filament Assembly Characteristics	Inherit characteristics of Filament Assembly	

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect**[1]
NC PROGRAMMING - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	
Laminate Thickness	The thickness of the laminate.	P
Boundary	The edge of the laminate.	P
Tolerances	The tolerance requirements relative to the ply laminate.	P
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	P
NC PROGRAMMING - CORE (MACHINED)		
Boundary	The edge of the core detail.	P
Core Thickness	The finished thickness of the core detail.	P
Core Density	The pounds per cubic foot of honeycomb core based upon the foil gauge or thickness and cell size.	P
Ramp Angle	The angle of segments of the core that are tapered.	P
Joints	The general area of contact.	P
Material Stock Size	The length and width of the material as it comes from the vendor.	P
Tolerances (thickness, location)	The degree of accuracy required when manufacturing the ACSP.	P
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb.	P
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	P
Mating Surface Contour	The contour (see above) of the mating surface to the core.	P

1 Aspect Codes F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
NC PROGRAMMING - CORE ASSEMBLY		
None		
NC PROGRAMMING - COMPOSITE LAYUP ASSEMBLY (CORE STIFFENED PANEL)		
None		
NC PROGRAMMING - COMPOSITE LAYUP ASSEMBLY ('T')		
None		
PROCESS PLANNING - FILAMENT ASSEMBLY (FABRIC/TAPE)		
Material Type/Description	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	P
Warp/Fill Direction	The direction of the longitudinally oriented yarn in a woven fabric./ The yarn in a fabric that crosses the warp.	P
PROCESS PLANNING - FILAMENT ASSEMBLY (FILLER)		
Material Quantity	The amount (number of strands of tow) required to produce the required cross section of the filler.	P
Cross Section Volume	The volume of a cross section of the filler.	P
PROCESS PLANNING - PLY PIECE		
Boundary	The geometry of the edge of the ply.	P
Warp/Fill Direction	The warp direction and whether its position is relevant.	P
Tolerance	The accuracy required when producing the ply.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Ply it is a Part of	Which ply contains this detail.	P
Filament Assembly Characteristics	Inherit the Filament Assembly characteristics.	
PROCESS PLANNING - PLY		
Boundary	The edge of the ply (EOP).	P
Filament Assembly Characteristics	Inherit characteristics of Filament Assembly	
Splice, Laps & Gap	Information about where and what type of splices are allowed and the allowable gaps and overlaps.	P
Tolerance	The accuracy required when producing the ply.	P
OML/IML	Any special requirements for the OML/IML plies.	P
Tooling Requirements.	A listing of the tools required to produce or layup the ply.	P
PROCESS PLANNING - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	
Number of ply(ies)	How many ply(ies) make up this ply laminate.	P
Ply Table	Information on the position and orientation of each ply.	P
Boundary	The edge of the laminate.	P
Tolerances	The tolerance requirements relative to the ply laminate.	P
Splice, lap & gap	The requirements for splice location and overlapping/gaps in plies.	P
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	P
OML/IML	Geometry of the OML/IML surfaces	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Ply Drop Off	The locations of the ply drop offs within the laminate.	P
Ply Orientation	The orientation of the plies within the laminate.	P
Warp	The warp direction of the plies and if it is relevant to the layup.	P
Compaction	Instructions for the compaction requirements for this layup.	P
PROCESS PLANNING - CORE (MACHINED)		
Boundary	The edge of the core detail.	P
Ramp Angle	The angle of segments of the core that are tapered. Used for illustration purposes only.	P
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb. Used for illustration purposes only.	P
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	P
Core Configuration	The configuration of the cells (i.e., hex, flex, or over extended)	P
PROCESS PLANNING - CORE ASSEMBLY		
Core (Machined) Characteristics	Inherit the characteristics of the machined core	
Adhesives (type)	Identity of the adhesives that will be used to assembly the details.	P
Potting Compounds	Identity of the potting compounds that will be used.	P
Stabilizers	Identity of the stabilizers that will be used.	P
Hard Detail Locations	The location of any hard details (fasteners, etc.) within the core assembly.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
PROCESS PLANNING - COMPOSITE LAYUP ASSEMBLY (CORE STIFFENED PANEL)		
Core Characteristics	Inherit characteristics from the core assembly.	
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	P
Reference Orientation	The orientation of the core and skins relative to the tool (rosette).	P
Adhesives (type)	The type of adhesive being used and its thickness.	
Location Tolerances	The positional accuracy required for the core assembly in the final cured ACSP.	
Tooling requirements	A listing of the tools required to layup the CSP.	
PROCESS PLANNING - COMPOSITE LAYUP ASSEMBLY ('T')		
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	P
Reference Orientation	The orientation of the laminates and filler relative to the tool.	P
Adhesives (type)	The identify of any adhesives required in the layup and the thickness.	P
Location Tolerances	The positional accuracy required for the completed assembly.	P
Tooling requirements	A listing of the tools required to layup the 'T' stiffener.	P
Filler Characteristics	Inherit the characteristics of the filler.	P
Identification of Transferable Process Steps.	A description of the process steps that may be performed at more than one station (transferred).	P
TOOL DESIGN - FILAMENT ASSEMBLY (FABRIC/TAPE)		
Material Type	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	P
TOOL DESIGN - FILAMENT ASSEMBLY (FILLER)		

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Boundary	The cross sectional shape and length of the filler.	P
Manufacturing Process	A description of the manufacturing process that will be used to produce the radius filler.	P
TOOL DESIGN - PLY PIECE		
None		
TOOL DESIGN - PLY		
Boundary	The edge of the ply detail (EOP).	P
Filament Assembly Characteristics	Inherit characteristics of Filament Assembly	
Tooling Requirements	A listing of the tools required to layup the ply.	P
OML/IML	Define whether the ply is OML or IML.	P
Cure Ply Thickness	The thickness of the ply when it is cured in this part configuration.	P
TOOL DESIGN - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	
Ply Thickness	The thickness of the laminate after curing.	P
Boundary	The edge of the laminate.	P
Tolerances	The tolerance requirements relative to the ply laminate.	P
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	P
OML/IML	Geometry of the IML and OML surfaces.	P
TOOL DESIGN - CORE (MACHINED)		

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Boundary	The edge of the core detail.	P
Core Thickness	The finished thickness of the core detail.	P
Core Density	The pounds per cubic foot of honeycomb core based upon the foil gauge or thickness and cell size.	P
Joints	The general area of contact.	P
Material Stock Size	The length and width of the material as it comes from the vendor.	P
Tolerances (thickness, location)	The degree of accuracy required when manufacturing the ACSP.	P
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb.	P
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	P
Core Configuration	The configuration of the cells (i.e., hex, flex, or over extended)	P
Mating Surface Contour	The contour (see above) of the mating surface to the core.	P
Tooling Requirements	A list of the tools required to layup the laminate.	P
TOOL DESIGN - CORE ASSEMBLY		
Core (Machined) Characteristics	Inherit the characteristics of the machined core	
Boundary	The outside edge of the core assembly.	P
Core Detail Position	The position of the details that make up the assembly. Includes location and orientation that will be used to mark reference directions on the tool.	P
Core Assembly Tolerances	The orientation and positional tolerances for the assembly.	P
Core Assembly Surface Contour	The relative contour of the surface of the core assembly.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

View - Composite Item		
Characteristic	**Description**	**Aspect[1]**
Hard Detail Locations	The location of any hard details (fasteners, etc.) within the core assembly.	P
Tool Design - Composite Layup Assembly (Core Stiffened Panel)		
Core Characteristics	Inherit characteristics from the core assembly.	
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	P
Reference Orientation	The orientation of the core and skins relative to the tool (rosette).	P
Boundary	The size and shape of the core assembly.	P
Location Tolerances	The positional accuracy required for the core assembly in the final cured ACSP.	P
Tooling Requirements	A listing of the tools required to assemble the core.	P
Forecasted Part Quantities	The number of assemblies that will have to be built with this tool.	P
Next Assembly Information	The attachment points of the finished part to other parts.	P
Tool Design - Composite Layup Assembly ('T')		
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	
Reference Orientation	The orientation of the laminates and filler relative to the tool.	P
Boundary	The dimensions of the completed assembly.	P
Location Tolerances	The positional accuracy required for the completed assembly.	P
Tooling Requirements	A listing of the tools required to assembly this ACSP.	P
Next Assembly	The attachment points of the finished part to other parts.	P
Forecasted Part Quantities	The number of assemblies that will have to be built with this tool.	P

1 Aspect Codes: F-Function M-Material S-Shape P-Process

VIEW - COMPOSITE ITEM		
Characteristic	**Description**	**Aspect[1]**
Assembly or Layup	Are any of the parts in the assembly process already cured?	P

1 Aspect Codes F-Function M-Material S-Shape P-Process

2.4.2 Characteristic Versus Functional Views Matrix

This section records the which views share common characteristics. The documentation of these relationships provides a cross-reference that provides the foundation for the integration of the Characteristics and their Aspects.

Table 3 Characteristics and Associated Functional Views

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Adhesive	Detail Design Detail Structural Analysis Manufacturing Planning Process Planning Preliminary Structural Analysis
Angle Characteristics	Detail Design
Angle Location	Detail Design
Assembly List	Detail Structural Analysis Preliminary Structural Analysis
Assemble or Layup	Tool Design
Assembly Symmetry	Detail Design
Bottom Surface	Detail Structural Analysis Preliminary Structural Analysis
Boundary	Detail Design Detail Structural Analysis Manufacturing Planning Process Planning NC Programming Preliminary Structural Analysis Structural Test Tool Design
Boundary/Envelope	Detail Design Detail Structural Analysis Preliminary Structural Analysis Structural Test
Cap Characteristics	Detail Design
Cap Location	Detail Design
Cell Size	Detail Structural Analysis

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Combined Material Properties	Detail Design Detail Structural Analysis Preliminary Structural Analysis Structural Test
Compaction	Process Planning
Contour	Manufacturing Planning
Contoured Mold/Bag Interface	Detail Design
Contoured OML/IML Surface(s)	Detail Structural Analysis Preliminary Structural Analysis Structural Test
Core Assembly Characteristics	Detail Structural Analysis Manufacturing Planning Preliminary Structural Analysis
Core Assembly Contour	Manufacturing Planning Tool Design
Core Assembly Tolerances	Manufacturing Planning Tool Design
Core Characteristics	Process Planning Tool Design
Core Detail Characteristics	Detail Design Detail Structural Analysis
Core (Machined) Characteristics	Manufacturing Planning Process Planning Tool Design
Core Configuration	Manufacturing Planning Process Planning Tool Design
Core Detail Identification	Detail Design
Core Detail Position	Manufacturing Planning Tool Design
Core Detail Thickness	Detail Design

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Core Density	Detail Design Manufacturing Planning NC Programming Tool Design
Core Holes and Cutouts	Detail Design
Core Normal	Detail Structural Analysis Preliminary Structural Analysis
Core Splice	Detail Design Manufacturing Planning
Core Stiffened Panel Assembly Process	Detail Design
Core Stock Characteristics	Detail Design
Core Thicknesses	Detail Design Manufacturing Planning NC Programming Tool Design
Core Type	Manufacturing Planning NC Programming Process Planning Tool Design
Cross Section Properties	Detail Design Detail Structural Analysis Preliminary Structural Analysis
Cross Section Volume	Manufacturing Planning Process Planning
Cure Ply Thickness	Tool Design
Damage Tolerance	Detail Design
Detail Structural Analysis	Detail Structural Analysis
Drape	Manufacturing Planning
Envelope	Detail Design
Fastener Holes and Cutouts	Detail Design
Fiber Orientation	Detail Design NC Programming

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Fiber/Resin Ratio	Detail Design Manufacturing Planning
Fiber Strength/Stiffness	Manufacturing Planning NC Programming
Fiber Volume	Detail Structural Analysis
Filament Assembly (Filler) Characteristics	Detail Design Detail Structural Analysis Manufacturing Planning NC Programming Process Planning Preliminary Structural Analysis Tool Design
Filler Characteristics	Detail Design Process Planning
Fill Surface	Detail Structural Analysis
Filler Plies	Detail Design
Finish	Detail Structural Analysis
Flat Pattern	Detail Design
Forecasted Part Quantities	Tool Design
Hard Detail Locations	Manufacturing Planning Process Planning Tool Design
Identification of Transferrable Process Steps	Process Planning
Joints	Detail Structural Analysis Manufacturing Planning NC Programming Preliminary Structural Analysis Structural Test Tool Design
Joints/Interfaces	Detail Design
Laminate Assembly Process	Detail Design

Characteristic Versus Functional Views Matrix

Characteristic	Functional Views
Ply Laminate Characteristics	Detail Design Detail Structural Analysis Manufacturing Planning Process Planning Preliminary Structural Analysis Tool Design
Laminate Thickness(es)	Detail Structural Analysis NC Programming Preliminary Structural Analysis Structural Test
Laminate Properties	Detail Design Detail Structural Analysis Preliminary Structural Analysis Structural Test
Laminate Symmetry	Detail Design
Location Tolerances	Manufacturing Planning Process Planning Tool Design
Manufacturing Process	Tool Design
Material Life Data	Manufacturing Planning
Material Name	Detail Design Manufacturing Planning NC Programming
Material Name/Description	Detail Structural Analysis Preliminary Structural Analysis
Material Quantity	Manufacturing Planning Process Planning
Material Stock Size	Detail Design NC Programming Tool Design
Material Thickness	Detail Design Detail Structural Analysis Manufacturing Planning NC Programming

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Material Type	Manufacturing Planning NC Programming Process Planning Tool Design
Mating Surface Contour	Manufacturing Planning NC Programming Tool Design
Mechanical Material Properties	Detail Design Detail Structural Analysis Preliminary Structural Analysis
Mold/Bag Interface	Detail Design
Next Assembly Information	Detail Design Detail Structural Analysis Preliminary Structural Analysis Structural Test Tool Design
Number of Ply(ies)	Manufacturing Planning Process Planning
Number of Ply Details	Detail Design
OML/IML	NC Programming Process Planning Tool Design
OML/IML Surface(s)	Detail Design Detail Structural Analysis Preliminary Structural Analysis Structural Test
Panel Size	Detail Design
Percentage Ply Angle/Thickness	Detail Design
Ply Characteristics	Detail Design Manufacturing Planning NC Programming Process Planning Tool Design
Ply Detail Characteristics	Detail Design Detail Structural Analysis

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Ply Detail Identification	Detail Design
Ply Detail Normal	Detail Structural Analysis
Ply Dropoff	Detail Design Process Planning
Ply Identification	Detail Design
Ply Location in Stack	NC Programming
Ply Normal	Detail Structural Analysis
Ply Orientation	Process Planning Preliminary Structural Analysis
Ply Percentages	Preliminary Structural Analysis
Ply it is a part of	Detail Structural Analysis NC Programming Process Planning
Ply Sequence Number	Detail Structural Analysis
Ply Stack	Detail Design
Ply Table	Detail Design Detail Structural Analysis Manufacturing Planning Process Planning
Ply Thicknesses	Tool Design
Ply Transition	Detail Design
Potting Compound	Manufacturing Planning Process Planning
Preliminary Structural Analysis	Preliminary Structural Analysis
Ramp Angle	Detail Design Detail Structural Analysis Manufacturing Planning NC Programming Process Planning

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Reference Orientation	Detail Structural Analysis Manufacturing Planning Process Planning Preliminary Structural Analysis Structural Test Tool Design
Reference Normal	Detail Structural Analysis Preliminary Structural Analysis
Resin Content	Detail Structural Analysis
Ribbon Direction	Detail Design Detail Structural Analysis Manufacturing Planning NC Programming Process Planning Preliminary Structural Analysis Tool Design
Shape	Detail Structural Analysis
Splice, Lap and Gap	Manufacturing Planning Process Planning
Stabilizer	Detail Design Manufacturing Planning Process Planning
Stack Normal	Detail Structural Analysis Preliminary Structural Analysis
Strength	Detail Design
Test Results	Structural Test
Tolerances	Detail Design Manufacturing Planning NC Programming Process Planning Tool Design
Tolerances (thicknesses, location)	Manufacturing Planning NC Programming Tool Design

Characteristic Versus Functional Views Matrix	
Characteristic	**Functional Views**
Tool Controlled Surfaces	Manufacturing Planning NC Programming Tool Design
Tooling Requirements	Process Planning Tool Design
Top Surface	Detail Structural Analysis Preliminary Structural Analysis
Warp	NC Programming Process Planning
Warp Surface	Detail Structural Analysis
Warp/Fill Directions	Detail Design Detail Structural Analysis Manufacturing Planning NC Programming Process Planning
Warp/Fill Percentages	Detail Design Detail Structural Analysis
Weave	Detail Design Detail Structural Analysis Manufacturing Planning
Weight	Detail Design Detail Structural Analysis Preliminary Structural Analysis Structural Test

2.4.3 Information Needs Summary and Assessments

This section presents the information needs summaries by view, and then the views that have been computerized at least to some degree are assessed as to the payback from utilizing PAS-C technology. The characteristics are prioritized by assessing the number of referencing composite items.

List of Needs

This list was created by identifying activities that have been computerized to some degree or another. These activities have a greater potential for electronic exchange of product data than non-computerized activities. The list consists of three columns. The first column identifies the

functional area(s) which usually performs the activity. The second column identifies the activities. The third column maps the activity to the functional nodes in section 2.3.

Functional View	Activity which Needs Information	Node #
Analysis	Material Properties Extraction	A223352133
Analysis	FEM creation from Overall part geometry	A22335211
Analysis	Detail stress analysis part geometry input	A2233531
Analysis	Updated geometry and ply data output to Design	A223356
Analysis	Graphical and Textual documentation of Analyses (Presentation)	A22335243 A22335244
Analysis	Input of Finite Element Analysis Output to Detail Structural Analysis	A2233532
Design	Drawing creation on graphics system (Presentation)	A223233
Design	3D creation of overall part geometry (Surfaces)	A223232
Design/NC	Flat Pattern creation of ply and ply detail geometry	A233163 A233211
Design/NC/Proc. Plan.	Creation of a Ply Book	A2321532
NC	Create NC program for cutting out ply detail on a Rapid Ply Cutting Machine (RPCM)	A23321
NC	Create NC program for laying tape using an Automatic Tape Laying Machine (ATLM)	A23321
NC	Create NC program for cutting Core to shape	A23321
NC	Create NC programs for trimming Edge-of-Part (EOP)	A23321
NC	Create NC program for machining tool mold surfaces	A23321
Tool Design/NC	Create Ply Templets	A23313
MFG Process Planning	Create Shop Floor Instructions and Illustrations	A232153
MFG Planning	Perform resource planning utilizing a Manufacturing Bill of Materials	A2313

Prioritization of Needs

Application areas that currently have a high degree of automation are high on the priority list. This is because PDES/STEP APs can impact these applications the quickest and greatest with the least amount of effort. When an activity is computerized/automated the reason is usually that a large volume of data was being processed, either within the activity or to-and-from the activity. To refine this prioritization criteria even more, APs should focus on exchanges of information where both sides of the exchange have automated process currently utilizing the same data, but manual interpretation of the information during the exchange still exist. There is also the case where having the product data standardized and computerized would lead to justifying automating activities that were not cost effective with manual input. An example of this would be generative process planning.

Table 4 contains the functional area interactions that show the greatest potential payback from utilizing PAS-C. Functional experts were asked to identify key ares where a standardized data format and appropriate functional systems would provide a substantial impact to the current way of doing business. The impacts represent the changes that would occur to the activities associated with sending, formatting, processing and receiving the information transferred between the functions. Low (LOW) impact represents a reduction of less than 10%, moderate impact (MOD) a reduction of 10% to 50%, and high (HI) impact an improvement of greater than 50%. An increase (INC) indicates that there may be additional effort required to complete those tasks. The Design to Analysis data exchange was expected to initially create more effort, but to eventually provide a moderate reduction.

Table 4 Functional Area Interactions

Functional View Data Exchanges	PAS-C Impact
Design to Analysis	INC -> MOD
Analysis to Design	MOD
Design to NC Programming	HI
Design to Manufacturing Process Planning	HI
Design to Tool Design	MOD

Another prioritization criteria is the number of times the same piece of information is utilized by different activities. Section 2.4, Table 2 shows the common information composite experts identified in the different functional areas. The informational characteristics in section 2.4.2 are the basis for the following table containing a prioritized list of information. The number of composite items that have a common characteristic was the primary ranking mechanism. The items in this list begin the task of best fulfilling the functional needs listed above. The table only

contains primary informational exchange elements and prioritizes them from top to bottom, top being the highest. The characteristics are also matched with their appropriate composite items.

Table 5 Characteristics Prioritization

Characteristics	Composite Item
Boundary	Ply Detail, Ply, Ply Laminate,Filament Laminate, Core, Composite Layup/Assembly
Boundary/Envelope	Core, Ply Laminate,Composite Layup/Assembly
Contoured OML/IML Surface(s)	Ply Laminate
Mating Surface Contour	Core
OML/IML Surface(s)	Ply Laminate, Core, Ply Detail, Ply, Composite Layup/Assembly
OML/IML	Ply, Ply Laminate
Combined Material Properties	Core, Composite Layup/Assembly
Laminate Properties	Ply Laminate
Mechanical Material Properties	Filament Assembly, Filament Laminate, Core
Material Properties	Core
Cross-Section Properties	Ply Laminate, Composite Layup/Assembly
Ply Table	Ply Laminate, Composite Layup/Assembly
Tolerance	Ply, Ply Detail
Tolerances	Ply Laminate, Core, Composite Layup/Assembly
Tolerances (thicknesses, location)	Composite Layup/Assembly, Core
Location Tolerances	Composite Layup/Assembly
Core Assembly Tolerances	Core
Damage Tolerance	Ply Laminate, Core, Composite Layup/Assembly
Next Assembly Information	Ply Laminate, Composite Layup/Assembly, Core

Characteristics	Composite Item
Weave	Filament Assembly
Warp/Fill Directions	Filament Assembly
Ribbon Direction	Core
Reference Orientation	Filament Assembly, Ply Detail, Ply, Ply Laminate, Core, Composite Layup/Assembly
Ramp Angle	Core
Laminate Thickness(es)	Ply Laminate
Core Thicknesses	Core
Material Thickness	Filament Assembly, Core
Weight	Ply Laminate, Composite Layup/Assembly, Core
Core Density	Core
Material Type	Filament Assembly
Core Type	Core
Adhesive (type)	Composite Layup/Assembly, Core
Material Name	Filament Assembly, Core

3 CONCLUSIONS and RECOMMENDATIONS

This section provides the reader with a summary of the Needs Analysis scope, IDEF0 model development, and characteristic identification and description. A list of identified information needs, a prioritized ranking of needs and criteria, and a description on how these needs will be used will also be summarized. Finally, some conclusions and recommendations will be presented.

3.1 Functional Needs Report Summary

Selecting the proper scope was a critical factor in performing the needs analysis documented in the Functional Needs Report for the PAS-C Program [2]. The three basic composite parts selected in [2] have a common nucleus of informational needs, as described in section 2.2.1 of this document. This common nucleus of these informational needs show up in most composite parts. The functional areas of Analysis, Design, and Manufacturing within the enterprise view of part producer was selected because these are the areas where most of the basic part description is created. Many of the same activities performed in these three functional area can also be performed within other enterprise views. Some functional activities were scoped out because it was believed they fell into other product item suites. Examples of this would be joining/fastening which would fall into an Assembly Product Item Suite and trim/drill which would fall into a Machined Part Product Item Suite.

3.2 IDEF0 Model Development

A series of IDEF0 models have been developed and documented for the Design, Analysis and Build views. A comprehensive node tree has been developed that includes all the views, along with general and part specific node trees for each of the three views. The nodes that were not decomposed with IDEF0 graphical models and accompanying glossaries were documented with textual definitions in Appendix C. The information in these diagrams served as a basis for the subsequent characteristic identification and description task performed by the PAS-C team and application experts.

3.3 Characteristic Identification and Description

A series of tables have been created that capture the information needs for each building block. The data recorded documents the characteristics for each functional view, their definitions and associated information aspects (function, material, shape, process). Another table documents a cross reference between characteristics and functional views. Finally a summary of the PAS-C information needs was presented and an assessment of information needs priorities was presented.

3.4 Satisfying the Identified and Prioritized Information Needs

The PAS-C Program will satisfy the list of prioritized needs, as described in section 2.4.3, by developing a standardized informational exchange schema/structure using STEP. This will be accomplished by comparing each composite part's informational need with current STEP information models to see which needs are fulfilled. Needs that are not fulfilled will be assessed as to how much effort would be required to fill the void in STEP. Based on this assessment, a plan will be created depicting the scope and resources required to develop a suite of Composite Part Application Protocols. This suite of application protocols will be integrated using common constructs such as identified in Table 2, Characteristic versus Functional View Matrix.

3.5 Conclusions

The next tasks in Phase I of the PAS-C program will build upon previous work. These tasks will add internal and external characteristic relationship constraint tables to the two tables developed in this document. The four types of tables and the IDEF0 models will then be used in combination with the needs SOTA comparison and assessments to produce a sound foundation for the PAS-C Application Protocol Suite development.

3.6 Recommendations

It is recommended that the Framework/Building-Block structure be used as an aid in establishing an overall framework for aiding development of IPO/ISO projects. What this methodology can provide is not only a way to decompose different product items and functional views into small manageable pieces but establishes a standard communication tool for describing project scopes and integration issues. This methodology is still being refined, but portions of it can still be useful presently at the IPO planning level. To start this process the IPO would have to take figure 2 and refine and standardize on the Product Item Suite axis and Enterprise View axis. More than one basic FW/BB will need to be developed, however having only one set of axes will establish/promote integration activities which have long been a problem in PDES/STEP development.

It is also recommended that PAS-C team members get more involved in related composite standards activities. This will promote greater acceptance and review of PAS-C deliverables. Two of these organizations are ASTM (American Society for Testing and Materials) and ISO TC61/SC13 Plastic/Reinforced Composites. These two organization's composites terminology was reviewed and incorporated where possible. Further clarification of their terminology needs to be pursued so that the PAS-C APs are truly usable standards.

With the basic FW/BB structure initiated, expansion areas and needed refinements have been identified. Obvious expansion areas are in the Material Supplier and Customer (procurement, use and maintenance) views. Sections of the Part Producer views such as Requirements, Testing, Quality Assurance and Support also need to be expanded. It is recommended that future work in expanding views start with an extension of the current FW/BB structure to insure that the

previously developed building block information can be optimally reused in future AP development.

Experience with the current IDEF0 toolset has shown the need for further development to optimize development efficiency. Further enhancement of the IDEF0 graphical tool and particularly the technology in automating the production of the glossary sheets is necessary.

The techniques developed and applied in the PAS-C Program have been successful. The information needs established and documented by the program have clearly established the need to carry forward with producing the Design, Analysis and Build PAS-C Application Protocol Suite.

REFERENCES

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3. PAS-C Sample Part Set, Document No. PASC003.01.00, 30 September, 1991

4. 1991 Annual Report for the PAS-C Program, Document No. PASC004.01.00, 30 September, 1991

5. PDES State-of-the-Art (SOTA) Assessment, Document No. PASC005.01.00, 23 December, 1991

6. Functional Needs IDEF0 Activity and Information Models, Document No. PASC006.01.00, 9 January, 1992

7. Standard Terminology for Advanced Composite Materials, ASTM D30,01 Ballot, Draft of August 30, 1991.

8. Engineered Materials Handbook, Volume 1, Composites, Copyright by ASM International, May 1988

9. Specifications & Standards for Plasties & Composites, Frank Traceski, Copyright by ASM International, August 1990

APPENDICES

APPENDIX A - FW/BB Methodology

The FW/BB Methodology which is being used in developing a PDES Composites Application Protocol Suite accomplishes the following tasks:

- Standardize physical components
- Establish application views
- Determine characteristics and their aspects
- Determine relationships among characteristics and their aspects
- Define Application Protocol requirements
- Recommend Application Protocol Suites

The methodology begins by standardizing a set of fundamental physical components that make up a composite part. These components are called composite items. A composite item can be as basic as a fiber or as complex as a composite assembly. The key is that composite items can be combined to form all the possible combinations of composite parts.

Next, a set of life-cycle functional views are established by determining the product life-cycle functional and dividing them into groups. These views can be as general or specific as necessary in order to communicate with various composite experts. Most experts come from particular disciplines such as analysis, design, manufacturing, engineering, etc. Thus, an initial set of views is established based on traditional company organizations that the experts will recognize. Within each organizational view, smaller detailed views can be created to facilitate the knowledge gathering process. Building activity node trees and IDEF0 models will facilitate the documentation of these views.

Each building-block, shown in figure 18 as the intersection of a composite item and a functional view, is examined to determine if its particular view (set of activities) requires additions or modifications to information about it's particular composite item. This examination is accomplished by an interviewing process that takes place in each individual view environment by subject experts to determine these requirements. This identified information is grouped as characteristics. These characteristics are composed of different combinations of aspects such as shape, function, material, and process. Figure 19 describes this FW/BB terminology. Once the interviews are completed, an industry review of this work must be made to verify its completeness and correctness. This will be done through the IGES/PDES Organization (IPO) Composites Committee, the International Standards Organization (ISO) TC 184/SC4 Working Groups, and/or other Composites/Standards Organizations

The size of the next task, interrelating composite characteristics and their aspects, is based on the success of the interview process and the depth of the knowledge collected. First, the relationships between aspects of the same characteristic should be determined. The line labeled R1 in figure 18 depicts this type of relationship in the FW/BB Methodology. Then, the relationships between characteristics of the same composite item should be identified from the same view and different views (along the view axis of figure 18). This should indicate real data dependencies and unique characteristic requirements. The detail integration is done on interrelating composite characteristics and their aspects. This detail integration is accomplished before creation of the actual information models. The detail integration and its positioning in the requirements gathering phase is a unique process of the FW/BB Methodology. Other modeling methods attempt to perform most of this detail integration during the creation of the actual information model. Our methodology takes into account that the majority of the composite experts can not communicate in a detailed information modeling environment such as IDEF1X but they can relate to an activity model (IDEF0). Specialized forms have been created to capture and communicate the necessary information to and from the composite expert for development of the scope, information requirements and the AAM. A snapshot of these forms are shown in Figure 20.

Once the information has been adequately collected, a decision point is reached to determine which Application Protocols (APs), in terms of scoping direction, should be pursued. The three basic choices are to scope APs by:

- Identifying information within a particular view (could be a functional department)
- Selecting two different views and identify the information that is exchanged between them
- Selecting a particular composite item or a characteristic of a composite item and standardize on its informational content throughout its entire life cycle

Characteristics and Their Aspects

Figure 21 shows examples of three AP scope choices. This figure shows how different building-blocks can be combined into different types of APs. This methodology provides an effective way to collect enough views of a particular type of information (characteristic), figure 18, so that a standard characteristic can be created that supports those views. This methodology can be applied to a few composite items, yet achieve great returns towards establishing and integrating PDES application protocols as well as Application Protocol Suites for composites. In this methodology, the simpler composite items should be addressed first because of the interdependencies in more complex composite items. The methodology sets up a framework where expansion points for new APs are easily identified and defined. Industry is provided with a tool to establish standard composite items that become the basic building blocks that tie Application Protocol Suite APs together.

The standard information characteristics that are uncovered by the PAS-C FW/BB Methodology will be represented by groups similar to the ARMs Units-of-Functionality (UoF). The PAS-C

"UoFs" will assist in the ARM-to-AIM mapping and the integration of different APs. This methodology is not intended to replace the IPO/ISO integration techniques for resource models and APs. The PAS-C method will enhance the current IPO/ISO integration techniques by:

(1) providing a preliminary integration of well defined concepts for ARM and AIM development and integration, and
(2) sharing a building-block methodology for AS development. The PAS-C method will allow standardization of fundamental information constructs for a composite item through out any number of life-cycle phases.

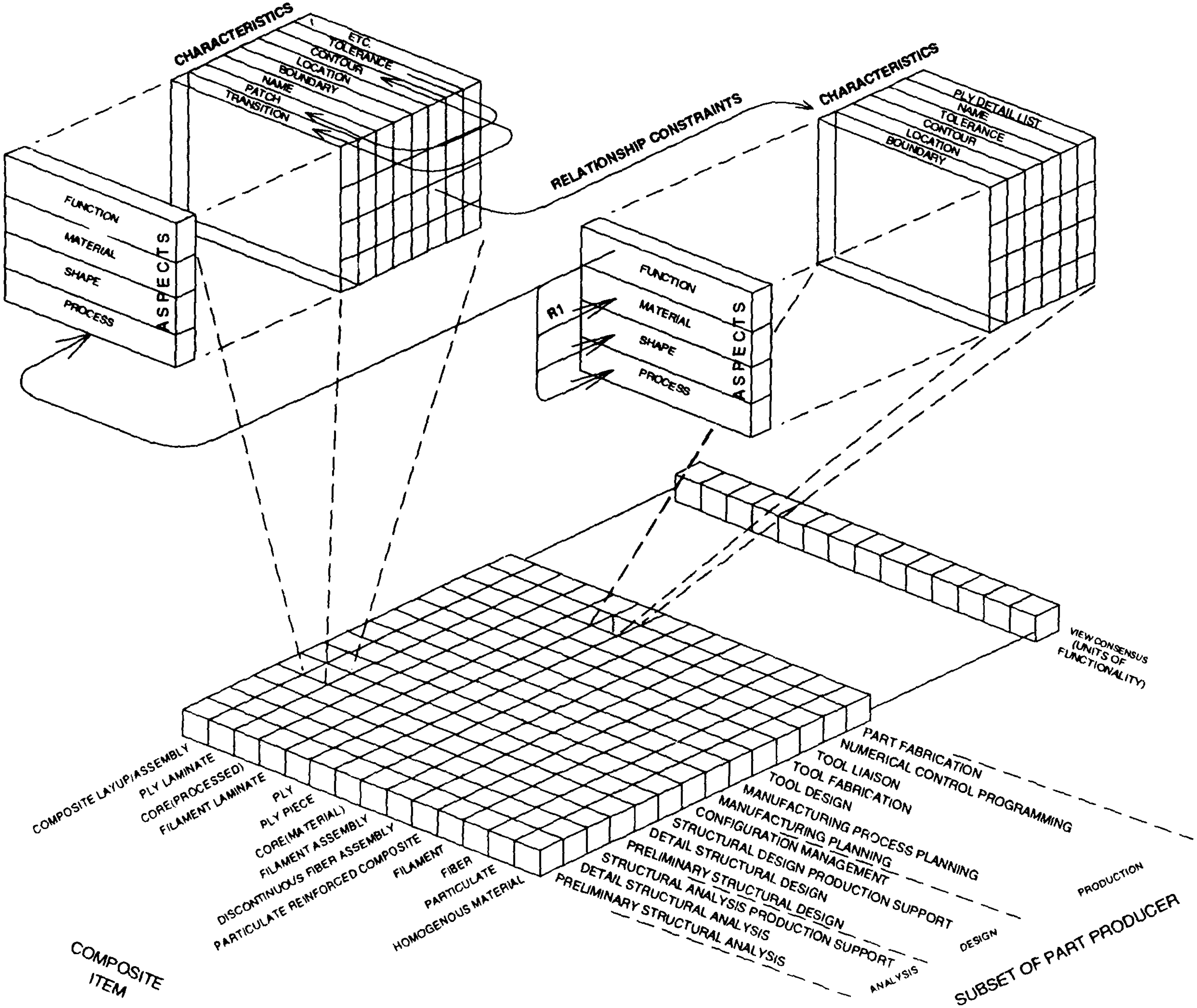

Figure 18 PAS-C Composite Item Terminology

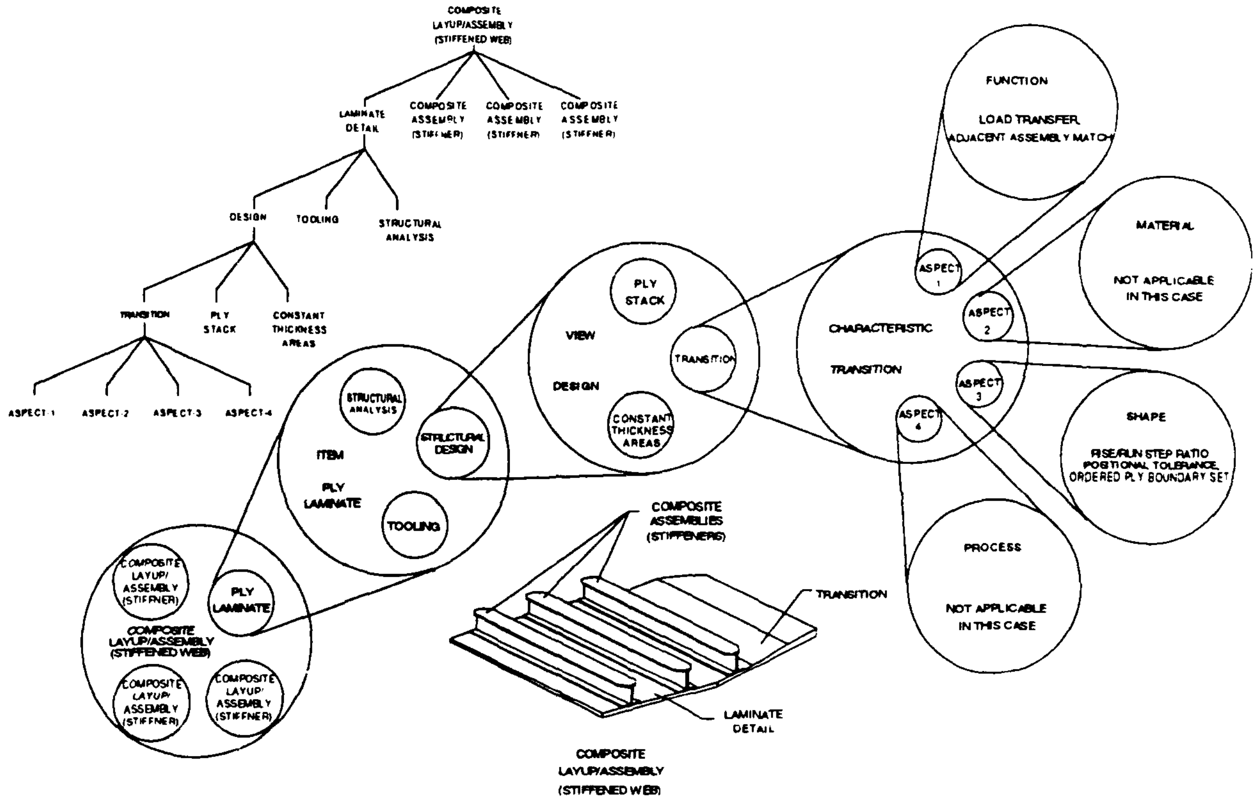

Figure 19 Aspects of a Transition Characteristic of a Ply Laminate from a Detail Structural Design View using FW/BB Terminology

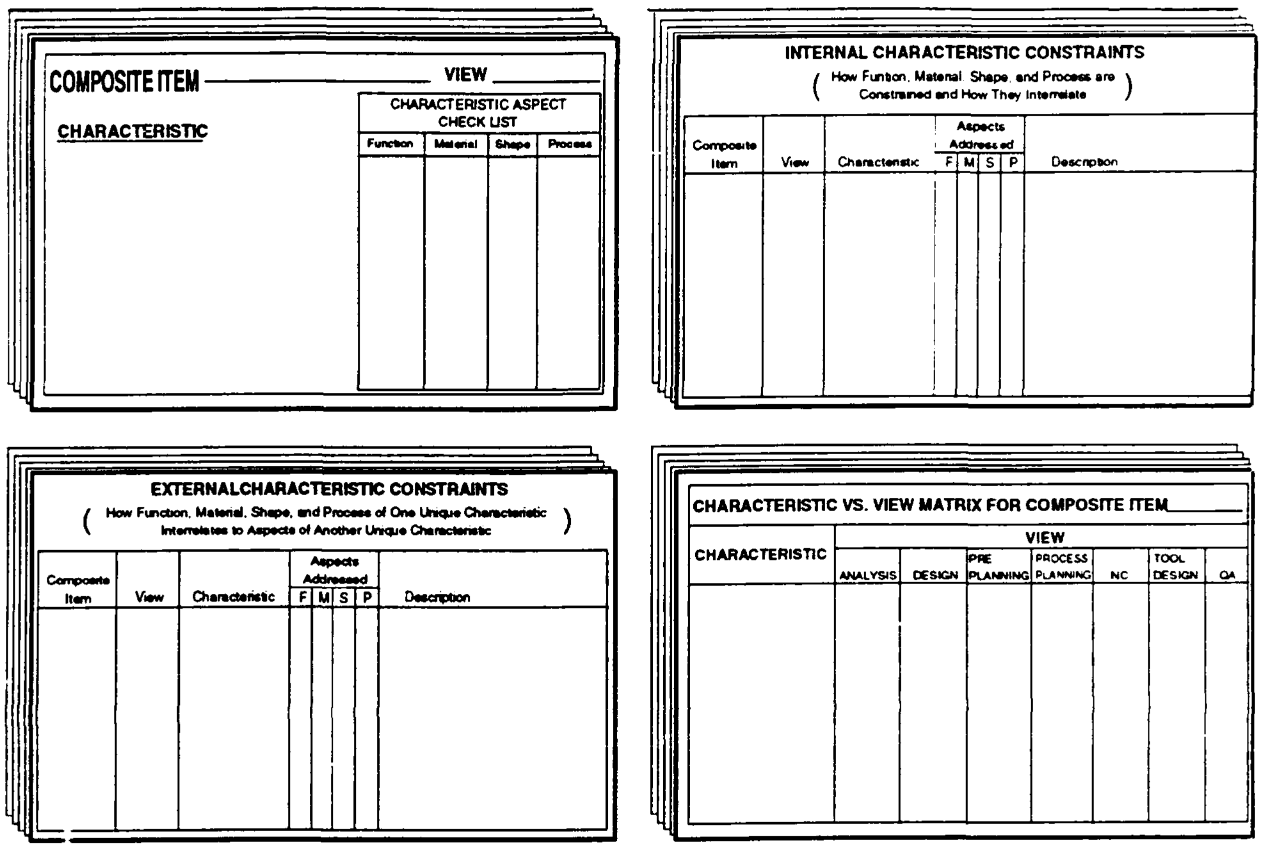

Figure 20 Forms that Capture Relationships Between Composite Characteristics and Their Aspects

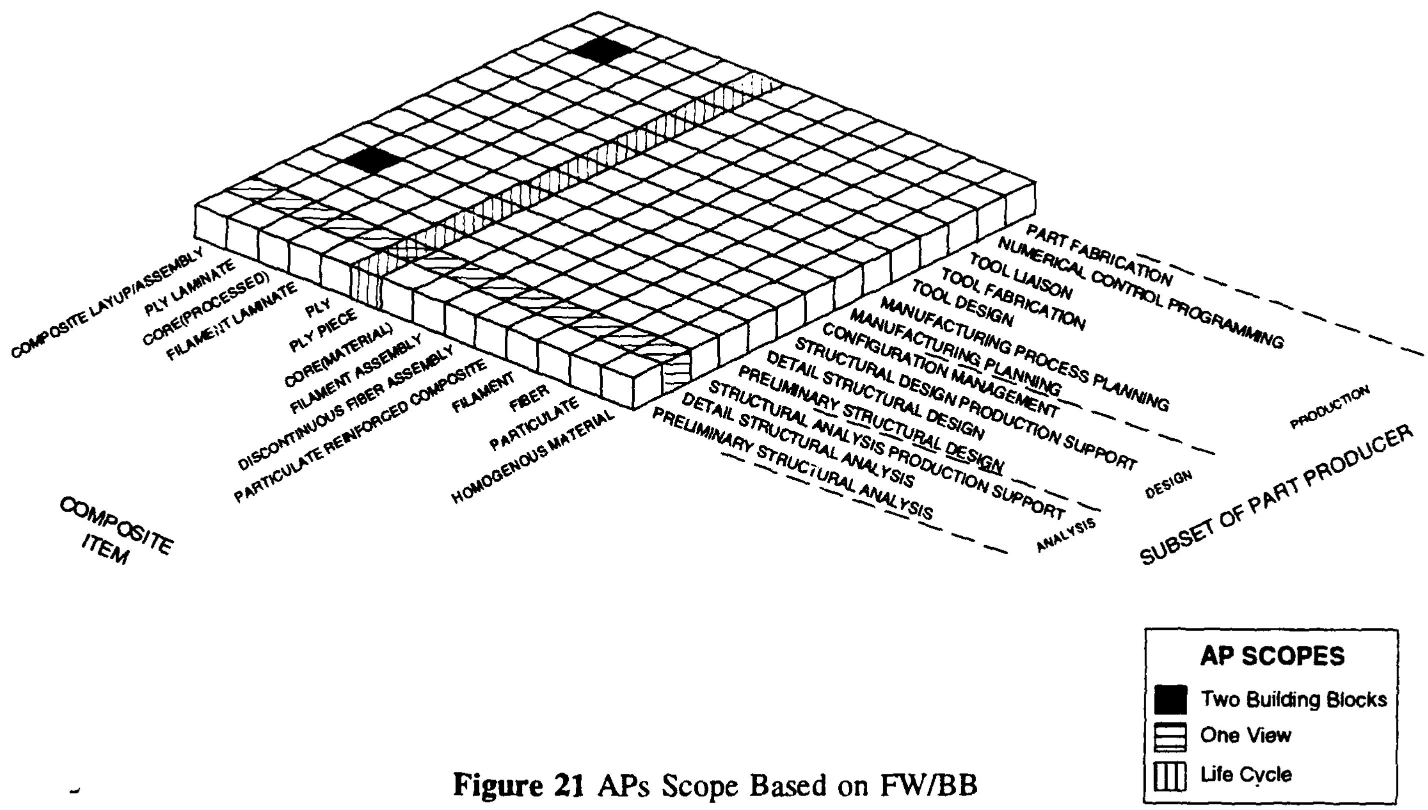

Figure 21 APs Scope Based on FW/BB

APPENDIX B - ISO Draft International Standard Carbon Fibre - Vocabulary

DRAFT INTERNATIONAL STANDARD ISO/DIS 10617

ISO/TC 61/SC 13 Secretariat: **AFNOR**

Voting begins on 1991-07-18 Voting terminates on 1992-01-18

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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1E 1F

Carbon fibre — Vocabulary

Fibres de carbons — Vocabulaire

UDC 677.494.745.32:001.4

Descriptors: plastics, fibres, synthetic fibres, carbon fibres, vocabulary.

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Pour accélérer la distribution, le présent DIS est distribué tel qu'il est parvenu du secrétariat du comité. La rédaction et la composition de texte seront effectuées au Secrétariat central de l'ISO au stade de publication.

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Carbon fibre — Vocabulary

1 . Scope

This International Standard defines terms*) in English and French relating to carbon fibres. Unless indicated otherwise all are nouns..

2. Normative references

The following standard contains provisions, which through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below, members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1139 - 1973 Textiles - Designation of yarns.
ISO 2076 - 1977 Man made fibres - generic names.
ISO 2078 - 1985 Textile glass yarns - designation.
ISO 472 - 1988 Plastics - vocabulary.

*) - In the text following terms and definitions taken from ISO 472 Plastics - Vocabulary are prefixed by asterisks..

3. Terms and definitions

3.1 General

3.1.1 * fibre: A unit of matter of relatively short length, characterized by a high ratio of length to thickness or diameter.

3.1.2 carbon fibre precursors: organic fibres, which by pyrolysis can be converted to carbon fibres.

NOTE - Polyacrylonitrile (PAN) fibres, pitch fibres and viscose fibres constitute the three principal types of fibre.
Precursors usually are in the form of continuous yarn, but can be woven or knitted fabric, braid, mats or felts.

3.1.3 carbon fibre: Fibre containing at least 90% by mass of carbon; obtained by pyrolysis of organic fibre precursors.

3.1.3.1 PAN-based carbon fibre: carbon fibre produced from polyacrylonitrile (PAN) precursor.

NOTE - A range of tensile strengths and moduli of elasticity may be obtained by adjusting the conditions of pyrolysis.

3.1.3.2 Pitch-based carbon fibre: carbon fibre produced from anisotropic and isotropic pitch precursors.

NOTE - The carbon fibres produced from isotropic pitch precursors have lower modulus of elasticity than those obtained from anisotropic pitch precursors, which can be processed to give high modulus of elasticity.

3.1.3.3 Viscose based carbon fibre : carbon fibre produced from viscose precursor.

NOTE - Production of carbon fibre from viscose precursor has virtually ceased apart from small scale production from viscose fabrics.

3.2 Processes

3.2.1. Oxidation : A thermal treatment in air of PAN, pitch or viscose carbon fibre precursor designed to oxidize the fibre in order to make it suitable for subsequent Carbonization and Graphitization.

3.2.2. Carbonization : A heat treatment to convert a carbon fibre precursor into carbon fibre by means of the chemical reactions which take place at temperatures below 1700°C in an inert atmosphere.

3.2.3. Graphitization ; A heat treatment carried out at temperatures in the range 1700°C to 3300°C in an inert atmosphere usually applied after the carbonization process.

NOTE - The process is known in the industry as "Graphitization" as it has the effect of modifying the physical and chemical properties of the carbonized fibre (3.2.2.), even though graphitic structure rarely can be observed in practice.

3.2.4. Surface Treatment : A treatment applied to the fibre to improve the adhesive bond between it and the resin component of the composite.

NOTE - Oxidation of the fibre surface carried out under controlled conditions is an example of surface treatment.
Fibres for the reinforcement of composite materials are usually Surface Treated, but for carbon-carbon composites or for metal matrices untreated fibres are preferred.

3.2.5. Size : The term size covers all materials applied to the fibres to facilitate the handling and use of the fibre.

3.3. Product form

3.3.1.* Braid : A planar or tubular fabric structure made by interlacing several carbon fibre yarns in such a manner that all yarns lie at an angle other than 0° or 90° to the length direction of the fabric.

3.3.2. Chopped fibre : Short fibre cut from yarn, not held together by any means.

NOTE - The chopped fibre may be sized for incorporation in injection moulding powders.

3.3.3. Desized fibre : Fibre from which the size has been removed by extraction with suitable solvents or by pyrolysis.

3.3.4. Felt : A structure characterized by the densely matted condition of most or all of the fibres from which it is composed.

3.3.5.* Filament : A single textile element of small diameter and very long length, considered as continuous.

3.3.6.* Folded Yarn , Plied Yarn : A general term designating yarn formed by twisting two or more single yarns in one folding operation. (See ISO 1139)

3.3.7.* Knitted fabric : A planar or tubular structure made by the intermeshing of loops of carbon fibre yarns.

3.3.8.* Mat : A product made of filaments, staple fibres or strands, cut or uncut, orientated or not, held together in the form of a sheet.

3.3.9. Monofilament : A single filament that is strong enough to function as a yarn.

3.3.10.* Multifilament : continuous filament : A class of textile materials consisting of assembled filaments.

3.3.11.* Needled mat : A mat formed of strands cut to a short length, felted together in a needle loom, with or without a carrier.

3.3.12.* Sliver : A continuous assembly of slightly bonded staple fibres in a practically parallel arrangement.

3.3.13.* Staple fibre: discontinuous fibre: A single textile element of small diameter and short length.

3.3.14. Staple Yarn : Yarn spun from staple fibres, bound together by twist.

3.3.15.* Strand : An assembly of simultaneously produced parallel filaments slightly bonded and without intentional twist.

3.3.16.* Unidirectional fabric : A fabric with a great number of yarns in one direction (usually the warp) and fewer and generally finer yarns in the other direction, resulting in a fabric much stronger in the first direction than the other.

3.3.17. Tow : A large number of filaments collected into a loose strand or assemblage substantially without twist.

3.3.18. Untreated fibre : Fibre which has not been subjected to the process of surface treatment.

3.3.19. Web : An assembly of fibres of reduced thickness with or without orientation held together by the adherence of the fibres or by appropriate means.

3.3.20. Woven fabric : A fabric made by interlacing two sets of threads (single, folded or cabled yarns) in at least two directions, perpendicular or at some specified angle, such interlacing being formed during weaving on a loom or weaving machine.

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EXPLANATORY REPORT RAPPORT EXPLICATIF	ISO/DIS 10617
will supersede: remplacera:	CD 10617
ISO/TC 61 /SC 13	Secretariat AFNOR

This form should be sent to the ISO Central Secretariat, together with the English and French versions of the committee draft, by the secretariat of the technical committee or sub-committee concerned (see 2.4.6 of part 1 of the IEC/ISO Directives)

Ce formulaire doit être envoyé au Secrétariat central de l'ISO en même temps que les versions anglaise et française du projet de comité, par le secrétariat du comité technique ou du sous-comité concerné (voir 2.4.6 de la partie 1 des Directives CEI/ISO)

The accompanying document is submitted for circulation to member body vote as a DIS, following consensus of the P-members of the committee obtained

Le document ci-joint est soumis, pour diffusion comme DIS, au vote comité membre, suite au consensus des membres (P) du comité obtenu

on / le 1990-09.

☒ at the meeting of / à la réunion du TC 61 /SC 13 : see / voir resolution No. / n° .... in / dans le document 61/13 N 111

☐ by postal ballot initiated on / par un vote par correspondance démarré le 19........

P-members in favour: / Membres (P) approuvant le projet: Canada, Colombie, Tchécoslovaquie, Allemagne, Hongrie, Italie, Japon, Pays-Bas, Pologne, Afrique du Sud, Espagne, Suède, Suisse, Royaume-Uni, URSS.

P-members voting against: / Membres (P) désapprouvent: USA, France

P-members abstaining: / Membres (P) s'abstenant:

P-members who did not vote: / Membres (P) n'ayant pas voté: Australie, Belgique, Brézil, Chine, Finlande, Inde, Iran, Iracq, Corée.

Remarks/Remarques

I hereby confirm that this draft meets the requirements of part 3 of the IEC/ISO Directives
Je confirme que ce projet satisfait aux prescriptions de la partie 3 des Directives CEI/ISO

Date 25 JUIN 1991

Name and signature of the secretary
Nom et signature du secrétaire
Mme ANNE-MARIE FEUILLE
Secrétaire de l'ISO/TC 61/SC 13

FORM 8A (ISO) FORMULAIRE 8A (IS

3.3.21.* Yarn : A general term covering specific types of textile structures, with or without twist, made of staple fibres or filaments.

NOTE - Structures without twist include multifilament, strand, and sliver. Structures with twist include single yarn, folded yarn, cabled yarn, and multiple wound yarn.

3.4. Types of carbon fibre

Carbon fibres are traditionally classified according to their mechanical properties, with particular reference to their tensile strength and moduli as determined by the appropriate ISO test method.

3.4.1. General purpose fibres : Fibres used for the reinforcement of plastics to confer improved electrical, electrostatic, electromagnetic, thermal or tribological properties.

NOTE - These fibres have lower tensile properties.

3.4.2. High tenacity fibre (HT) : A type of fibre with a tensile strength exceeding 2500 MPa and tensile modulus between 200 and 280 GPa.

NOTE - This type of fibre is also known as High Strength (HS), High Strain (HS) or Standard Grade fibre,.

3.4.3. Intermediate modulus fibre (IM) : A type of fibre with a tensile modulus in the range 280 to 350 GPa.

NOTE - In this category of fibre there are also fibres of very high tenacity equal to or greater than 5000 MPa.

3.4.4. High modulus fibre (HM) : A type of fibre with a tensile modulus greater than 350 GPa and less than 600 Gpa.

3.4.5. Ultra High Modulus Fibre (UHM) : A type of fibre with a tensile modulus in excess of 600 GPa.

APPENDIX C - Node Definitions

GENERAL DEFINITIONS

A0 Procure, Build, & Use an Aircraft Composite Structural Part - This activity covers the entire life-cycle of an ACSP as viewed from the combined activity groupings of the DoD needs analysis and procurement, Aerospace contractors, DoD's use and maintenance, and the raw material suppliers.

A1 Develop ACSP Needs & Procurement - This activity is the DoD Analysis of the ACSP needs based on the departments force structure needs and the state of ACSP technologies, along with the procurement process throughout the life cycle as managed at DoD level.

A2 Manage, Design, Build, & Support an ACSP - This activity consists of all the contracted management of resources, design, build, and support of a typical ACSP.as done at the prime contracting Aerospace Company.

A21 Manage ACSP Integrated Product Development (IPD) - This activity involves managing all of the resources specific to a ACSP through the design, build, and support functions. This includes people, budgets, tools, materials, etc.

A211 Manage ACSP Design Process - This activity consists of managing the design functions and the relationships within and external, throughout the ACSP development life cycle.

A212 Manage ACSP Build Process - This activity consists of managing build functions and the relationships within and external, throughout the ACSP development life cycle.

A213 Manage ACSP Support Process - This activity consists of managing support functions and the relationships within and external, throughout the ACSP development life cycle.

A214 Manage ACSP Resources - This activity consists of managing all the people, tool, facility, time and cost resources necessary for the ACSP development

A2141 Manage ACSP People Resources - This activity consists of managing all the required staff and skills necessary for the ACSP development.

A2142 Manage ACSP Tool Resources - This activity consists of managing all the required tools necessary for the ACSP development.

A2143 Manage ACSP Facility Resources - This activity consists of managing all the required facilities necessary for the ACSP development.

A2144 Manage ACSP Time and Cost Budgets - This activity consists of managing all the required time and cost budgets necessary for the ACSP development.

A215 Manage ACSP Integration - This activity consists of managing all the required time and cost budgets necessary for the ACSP development.

A22 Design & Analyze an ACSP - This activity involves the complete design and analysis life-cycle of the ACSP from the pre-proposal phase to product support in the field, as supported by the design function.

A22211 Evaluate ACSP Preliminary Loads - Review and understand the preliminary loads for optimum load transmission paths within the preliminary ACSP design concepts.

A22212 Obtain ACSP M&P Support - Coordinate with Materials and Processes functions in selecting candidate materials for the preliminary ACSP structure.

A22213 Prepare ACSP Design Concepts - Prepare layouts of the most promising ACSP concepts in sufficient detail to allow for comprehensive trade studies.

A222131 Select ACSP Geometry System - Review the various internal and external constraints that must be satisfied by the geomtry creation system for this phase of the ACSP development.

A222132 Build ACSP Concept Geometry - Build ACSP configurations to initiate an interactive cycle of configuration sizing and refinement.

A2221321 Develop ACSP Structural Concepts - Define the viable ACSP structural concepts to the detail necessary to perform engineering and producibility trade studies.

A2221322 Prepare ACSP Candidate Drawings - Using the selected drawing system, prepare ACSP design layouts defined to a sufficient level of detail to perform the interdisciplinary trade studies.

A2221323 Evaluate ACSP Analysis Results - Review the available analysis results to determine if any deficiencies exist in the ACSP design concepts.

A2221324 Develop ACSP Trade Study Concepts - Conduct performance, producibility and environment analyses on the various ACSP concepts to arrive at a matrix of parameters that show configuration sensitivity.

A2221325 Select/Detail Preliminary ACSP - Select the design concept based on the results of the inter-disciplinary trade study, then develop the detail necessary for formal customer reviews.

A2222 Conduct Preliminary ACSP Analysis - Conduct preliminary analyses to support the conceptual design function. Provide analytical support of the review of design data such as layouts and materials, conduct baseline and trade studies and the definition of design criteria.

A22221 Review ACSP Design Data - Review conceptual layouts and geometry for structural adequacy and load paths.

A222211 Review ACSP Layouts - Review conceptual structural layouts for adequate load paths and feasibility.

A2222111 Review ACSP Geometry - Review conceptual geometry such as plies. stiffeners and cutouts for structural adequacy.

A2222112 Review ACSP Sizes - Review sizes such as thicknesses, total number of plies, and stiffener geometry for structural adequacy.

A2222113 Obtain ACSP Initial Weights and Balances - Apply computational and parametric weight estimation tools to estimate initial weights and the resulting balance.

A222212 Review ACSP Material Selections - Survey appropriate materials with the aim of selecting a composite or homogeneous material considering available data and performing tests as necessary.

A2222121 Select ACSP Composite or Homogeneous Material - Use weight, cost and structural performance criteria to select a composite or homogeneous material.

A2222122 Screen ACSP Available Materials - Use cost and structural performance criteria to screen available materials.

A2222123 Collect ACSP Existing Material Data - Collect existing data needed to support baseline and trade analyses, and the definition of design criteria.

A2222124 Define ACSP Material Development Program - Define a material development and coupon test program to collect the materials data that is not already in existence.

A2222125 Generate/Collect/Reduce ACSP Material Test Data - Perform a development and coupon test program to collect the materials data that is not already in existence.

A2222126 Create ACSP Analysis Materials Database - Create the information structure for an Analysis Materials Property Database, and supporting software as necessary. Load the new and existing collected materials test data into the database.

A222213 Conduct ACSP Baseline Analysis - Conduct analyses of the initial conceptual configuration to provide a starting point for trade study analyses.

A2222131 Define ACSP Critical Dimensions - Use the results of the initial analyses to define the critical structural dimensions to provide adequate structural performance and margins of safety.

A2222132 Define ACSP Structural Configuration - Use the results of the initial analyses to define structural thicknesses, potential stiffeners, and potential core stiffening.

A222214 Conduct ACSP Trade Study Analysis - Use the baseline structural configuration as a starting point for analytical optimization of critical dimensions and structural configurations subject to structural performance, cost and margin of safety constraints.

A2222141 Optimize ACSP Critical Dimensions - Perform analyses to optimize the critical dimensions of structural components.

A2222142 Optimize ACSP Structural Configuration - Use the results of the initial analyses to optimize structural thicknesses, potential stiffeners, and potential core stiffening.

A2222143 Support ACSP Design Trades - Provide analyses to provide data to support design tradeoffs. An analysis of a part with a different stiffener distribution would be a typical task.

A22222 Define ACSP Design Criteria - Use the SOW specifications, expected environments and structural limits to define design criteria.

A222221 Review ACSP SOW Specifications - Review SOW requirements for clarity, completeness and sensibility.

A222222 Select ACSP Environments - Using SOW requirements and engineering judgement select the environmental criteria.

A222223 Select ACSP Limits - Using SOW (Statement of Work) requirements and engineering judgement select the design limits.

A2233 Conduct Detail ACSP Analysis - Conduct all of the necessary static, dynamic, thermal, and mass property analyses required for the ACSP.

A22331 Collect Baseline ACSP Design Data - The collections of baseline ACSP design data includes the selected preliminary design, test data, producibility and maintainability studies.

A22331 Conduct ACSP Static Loads Analysis - Conduct analyses to calculate the all types of loading, such as aerodynamic, inertial, etc. This activity is not detailed as there is no specialized composite application.

A22332 Build ASCP Model & Drawing Tree - A model/drawing tree is developed for the ACSP, which specifies the combinations of composite items used to create the ACSP.

A22332 Conduct ACSP Thermal Analysis - Conduct analyses to calculate thermal loads from such sources as aerodynamic heating and engine waste heat. This activity is not detailed as it is not applicable to the selected part family.

A22333 Conduct ACSP Dynamic Analysis - Conduct analyses to evaluate the dynamic response of the structural part. This activity is not detailed as it is not applicable to the selected part family.

A22333 Prepare ACSP Model & Drawings - Prepare the ACSP models and drawings using the reviewed design inputs and creating the necessary outputs for other functional use.

A223331 Select & Prepare Model/Draft System - Select and prepare the modeling/drafting geometry system to be used for the detail design phase of the ACSP.

A223332 Create ASCP Geometry Layouts & Models - Create all of the necessary ACSP geometry layouts and models from the various inputs and prepare the data for transfer to other functions.

A2233321 Receive & Review ACSP Geometry Data - Receive and review all the different forms (paper, translated, native) of ACSP geometry data that will be necessary to develop the ACSP geometry.

A22333211 Receive & Review Paper Geometry Data - Receive and review all the paper geometry data necessary to develop ACSP geometry.

A22333212 Receive & Verify CAD Translated Data - Receive & verify the translated CAD data as delivered from other CAD systems.

A22333213 Receive & Review Native CAD Data - Receive and review the native CAD data as received from similar CAD systems.

A2233322 Build ASCP Layouts & Models - Build the ACSP layouts and models using the various geometry inputs.

A22333221 Select ACSP Construction Planes - Select the ACSP construction planes that render the desired views of the ACSP for top, front, side or cross-section details.

A22333222 Create ACSP 2-D Envelope - Create the ACSP 2-D envelope geometry using conventional 2-D drawing entities within the selected construction planes.

A22333223 Create ACSP 3-D Wireframe - Create the ACSP 3-D wireframe geometry using conventional 3-D drawing entities.

A22333224 Create ACSP Surface - Create the ACSP surface geometry using conventional surface modeling entities.

A22333225 Create ACSP Solid - Create the ACSP solid geometry using conventional or specialized solid entities.

A2233323 Prepare ACSP Data for Transfer - Prepare the ACSP data transfer to other functions in either paper, translated or native form to other functions.

A223333 Create ACSP Drawing Data - Create all the ACSP drawing data from the geometry and engineering specifications inputs using the selected systems.

A2233331 Create ACSP Tooling I/F Drawings - This is the creation of all the ACSP Inner Mold Line (IML) and/or Outer Mold Line (OML) tool interfaces to the ACSP. These drawings are also referred to as envelope drawings.

A2233332 Prepare Detail ACSP Composite Item Drawings - This activity is the preparation of the detail composite item's drawings that make-up the ACSP.

A22333321 Select & Detail ACSP Part Views - Select and detail the necessary ACSP part views based on the typical top, front, side and cross-sections needed to show the desired features.

A22333322 Prepare Detail ACSP Composite Item Drawings - Prepare the ACSP details to resolve the interfaces, joints, panel size and the development of the detail composite drawings.

A223333221 Resolve ACSP Interfaces & Joints - Resolve all the mating interfaces to the ACSP that involve mechanical or bonded joints. Look at space constraints, attachment issues and material compatibility.

A223333222 Resolve ACSP Panel Size Issues - Resolve all the size issues regarding the ACSP panel size due to tooling constraints and general design rules regarding the length and width features.

A223333223 Create ACSP Data - Create all the ACSP design data necessary for detail composite drawings and associated engineering notes.

A22333323 Attach ACSP Dimensions & Tolerances - Attach all the necessary dimensions and tolerances to the geometry of the drawing.

A22333324 Attach ACSP Composites Engineering Notes - Attach all the ACSP composites engineering notes on the drawing. They specify process specifications, change notes, material callouts, etc.

A22333324 Attach ACSP Composites Engineering Notes - Attach all the ACSP composites engineering notes on the drawing. They specify process specifications, change notes, material callouts, etc.

A22333325 Prepare & Coordinate Signature Process - All of the responsible reviews of the drawings, as noted on the signature block, are coordinated for their specific functional reviews and signature.

A22333325 Prepare & Coordinate Signature Process - All of the responsible reviews of the drawings, as noted on the signature block, are coordinated for their specific functional reviews and signature.

A2233333 Integrate & Prepare ACSP Assembly Drawings - Integrate and prepare all of the composite items that make up the ACSP into an integrated assembly drawing.

A2233334 Prepare & Release ACSP AMRs - All of the Advanced Material Requests (AMR)s needed by the engineering function are prepared and released so the material necessary for the build cycle will be on dock.

A2233335 Prepare ACSP Installation Drawings - All of the other subassemblies or assemblies that the ACSP is used on are shown on specific installation drawings.

A223334 Update ACSP Drawing & Model Data - Update the ACSP drawings and models based on the changes to the ACSP.

A22334 Build ACSP Parts List - Build an ACSP parts list of the components that make up the ACSP. -

A22335 Perform Cross-Funct. ACSP Reviews & CDR Functions - Perform the necessary cross-functional and customer design reviews to support the critical design review phase.

A22334 Conduct ACSP Mass Properties Analysis - Conduct analyses to evaluate the total weight and mass distribution of the structural part. This activity is not detailed as there is no specialized composite application..

A22335 Conduct ACSP Static Stress Analysis - Stress analysis is a contractual requirement for ACSP structures to insure the integrity of the airframe during usage within operational limits.

A223351 Create ACSP Static Stress Analysis Decision Record - Create a record of the decisions and idealizations made during the static stress analysis.

A223352 Conduct ACSP Finite Element Analysis (FEA) - Conduct static stress analysis using Finite Element Analysis techniques on digital computers.

A2233521 Generate ACSP Finite Element Models - Generate a discrete geometric approximation of the structural part. Generate and assign elemental connectivity, geometric and material attributes. Set boundary conditions and generate and assign the loading environment. Generate the directives necessary to control the analyses and resulting output.

A22335211 Generate ACSP Node Geometry - Discretize the surface or volume of the structural part by creating point geometry identical or related to the structural part geometry. Placement of the nodes on or within the structural part is governed by the fineness of the mesh needed to adequately discretize the deflection and strain fields of the structural part under the applied loading environment.

A223352111 Hand Generate ACSP Node Geometry - Generate node geometry by measuring parts, scaling drawings, or freehand, and hand input the nodal coordinate data into a computer disk file.

A223352112 Input ACSP Geometry from PDES/STEP Exchange File - Import geometry from a PDES/STEP file into a Finite Element mesh creation and editing program. Nodal geometry is then created from the computer representation of the structural part. Computerized applications may be used to au'omate node generation.

A223352113 Create ACSP Node Geometry from Existing Geometry - Nodal geometry is created from the existing computer representation of the structural part. Computerized applications may be used to automate node generation.

A22335212 Generate and Assign ACSP Element Connectivities - Connect element to corner, mid-edge, mid-face and mid-volume nodes to approximate the continuum of the structural part.

A22335213 Generate and Assign ACSP Element Attributes - Generate and assign element geometrical, material and ply related attributes.

A223352132 Generate ACSP Material Orientation Angles or Coordinate Systems - Generate material orientation angles by relating elements to coordinate systems, or by individual calculations. Alternatively a material direction may be assigned to a coordinate system reference.

A223352133 Generate/Import ACSP Material Properties - Either generate, import or retrieve from a database of material properties.

A2233521331 Import ACSP Material Properties from PDES/STEP Exchange File - Import material properties from a PDES/STEP Exchange File, and retrieve the necessary data.

A2233521332 Import ACSP Material Properties from Analysis Materials Database - Import material properties from an analysis materials database, and retrieve the necessary data.

A2233521334 Input ACSP Anisotropic Material Property Matrices - Input material property matrices data.

A223352134 Assign ACSP Material, Geometric, Material Coordinate System/Angle Attributes to Elements - Assign the material, geometric, material coordinate system/angle attributes as appropriate to elements.

A22335214 Generate ACSP Graphical Finite Element Model Documentation - Generate the graphical documentation of the nodes and elements, and their associated attributes.

A2233522 Generate ACSP Finite Element Analysis Environment and Controls - Generate, set, and assign Analysis environment data such as boundary constraints, loads, factors of safety, and set up the control of analysis output and the analysis procedure itself.

A22335221 Set and Assign ACSP Boundary Constraints and Releases - Set and assign boundary constraints and releases that approximate the support and/or symmetry boundary conditions for the analysis of the structural part.

A22335222 Generate and assign ACSP Load Sets and Combinations. - Generate and assign nodal and elemental loadings that approximate the forces, temperatures and/or displacements acting on the structural part, and request the combination of load sets to approximate complicated loading conditions from simpler loading components.

A22335223 Assign ACSP Factors of Safety, Durability/Damage Tolerance Allowables - Assign acceptable factors of safety, durability and damage tolerance allowables for elements.

A22335224 Generate and Assign ACSP Analysis Output Control Requests - Generate and assign output control requests for each of the types of data required to be output.

A223352241 Request ACSP Deflection Data Output - Request that deflection data be output from the Finite Element Analysis.

A223352242 Request ACSP Stress Data Output - Request that stress data be output from the Finite Element Analysis.

A223352243 Request ACSP Strain Data Output - Request that strain data be output from the Finite Element Analysis.

A223352244 Request ACSP Interlaminar Shear Data Output - Request that interlaminar shear data be output from the Finite Element Analysis.

A223352245 Request ACSP Reaction and Internal Load Data Output - Request that reaction and internal load data be output from the Finite Element Analysis.

A223352246 Request ACSP Generation/Output of Matrices - Request the generation and/or output of matrices such as reduced stiffness and substructures.

A22335225 Generate ACSP Analysis Procedure Controls - Generate the necessary directives to control the analysis process in the intended analysis code.

A2233523 Perform ACSP Mechanical/Thermo-mechanical Finite Element Analysis - Perform linear or nonlinear mechanical/thermo-mechanical analyses of the structural part by submitting the completed finite element model for analysis by the appropriate finite element analysis application.

A22335231 Perform ACSP Linear Analysis - Perform linear analysis of the structural part by submitting the completed finite element model to a finite element application that supports linear static analysis.

A22335232 Perform ACSP Nonlinear Stability Analysis - Perform nonlinear stability analysis of the structural part by submitting the completed finite element model to a finite element application that supports nonlinear static analysis.

A22335233 Perform ACSP Nonlinear Material Analysis - Perform nonlinear material analysis of the structural part by submitting the completed finite element model to a finite element application that supports nonlinear material static analysis.

A22335234 Perform ACSP Nonlinear Geometry Analysis - Perform nonlinear geometric analysis of the structural part by submitting the completed finite element model to a finite element application that supports nonlinear geometric static analysis.

A22335235 Perform ACSP Combined Geometric and Material Nonlinear Analysis - Perform combined nonlinear geometric and material analysis of the structural part by submitting the completed finite element model to a finite element application that supports combined nonlinear geometric and material static analysis.

A2233524 Create/Document ACSP Internal Loads/Stress Database - Create and document an internal loads and stress database by inputting data from an existing solution or a PDES/STEP Exchange File, and then documenting it with textual and graphical post-processing applications.

A22335241 Translate ACSP Data from FEA Solver - Translate analysis output data from an existing solution into an internal loads/stress database application.

A22335242 Translate ACSP Data from PDES/STEP Exchange File - Translate analysis output data from a PDES/STEP Exchange File into an internal loads/stress database application.

A22335243 Generate ACSP Textual Analysis Output Database Documentation - Generate textual documentation of the internal loads/stress database such as min/max margin of safety distributions for skin elements, or a force freebody of a stiffener.

A22335244 Generate ACSP Graphical Analysis Output Database Documentation - Generate graphical documentation of the internal loads/stress database such as color fringe plots of strain distributions over a skin.

A223353 Conduct ACSP Detail Stress Analysis - Conduct part detail stress analysis of part details such as fasteners and cutouts using handbook and automated methods. The internal loads/stress database or hand generated loads are used to supply the input data for these analyses. These analyses are used to support drawing signout, and final documentation.

A2233531 Conduct ACSP Static Strength Analyses - Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A2233531333 Generate ACSP Material Properties from Ply Properties, Stacking Sequence and Orientations - Generate material properties from ply properties, stacking sequence and orientations.

A2233532 Conduct ACSP Fine Grid Finite Element Analysis - Conduct fine grid finite element analyses of details of the structural part that were not appropriate to include in the overall structural part (coarse grid) finite element analysis.

A22335321 Generate ACSP Fine Grid Finite Element Model from Coarse Grid Model - Use the existing structural part finite element model to provide a geometric basis for generating a finer grid mesh to provide more deflection and strain resolution for a detailed finite element analysis.

A22335322 Apply ACSP Loads/Boundary Conditions from Coarse Grid Model - Use data from the internal loads/stress database to provide applied loads and displacements for the fine grid analysis.

A22335323 Perform ACSP Finite Element Analysis - Perform finite element analyses as in A2233523.

A22335324 Calculate ACSP Margins of Safety Based upon Fine Grid Analysis Results - Use data from overall structural part and fine grid finite element analyses to assign margins of safety for structural details of the structural part.

A22335325 Create ACSP Fine Grid Internal Loads/Stress Database Results - Create an internal loads and stress database by inputting data from the fine grid analysis.

A223354 Plan ACSP Tests/Analyze Test Results - Plan and analyze the output from element and sub-component structural test of the structural part to validate analyses.

A2233541 Produce ACSP Test Part Configuration Documents - Produce documents to define the configuration of the part and supporting test fixtures.

A2233542 Produce ACSP Test Plan - Produce documents defining the testing of the structural part.

A2233543 Perform ACSP Test Surveillance, Validation and Data Review - Monitor the structural tests, validate the output, and review and document results.

A2233544 Produce ACSP Test Results Documentation and Feed Back Information to Design - Document the results of ACSP testing and feed back the resulting assessments to design.

A223355 Analyze ACSP Manufacturing Discrepancies - Inspect, gather analysis input data, research and apply analyses, end recommend and document the disposition of discrepant parts.

A223356 Feed Back ACSP Laminate Description, Ply Stacking Sequence and Orientation to Design - Feed back any changed laminate descriptions, ply stacking sequence and orientations to design.

A22336 Conduct ACSP Durability and Damage Tolerance Analyses - Conduct durability and damage tolerance analyses to classify parts into critical and otherwise, guide material and allowables selection, set non-destructive inspection criteria.

A223361 Classify ACSP Parts into Safety of Flight/Fracture Critical and Others - Classify structural parts as safety of flight critical or otherwise based upon damage and environmental threats.

A2233611 Apply ACSP Damage Tolerance Criteria/Size to Safety of Flight/Fracture ACSP - Classify and apply structural parts as safety of flight critical based upon typical damage threats such as scratches, delaminations and impacts.

A22336111 Apply/Size ACSP Based on Scratches - Set criteria for allowable scratches in the surface of structural parts, and size the structural part to resist the threat.

A22336112 Apply/Size ACSP Based on Delaminations - Set criteria for delamination of structural parts, and size the structural part to resist the threat.

A22336113 Apply/Size ACSP Based on Impacts - Set criteria for impacts in the surface of structural parts, and size the structural part to resist the threat.

A22336114 Apply/Size ACSP Based on 1/4" Holes/Crack criteria - Set criteria for 1/4" holes or cracks in structural parts, and size the structural part to resist the threat.

A2233612 Apply ACSP Durability and Environmental Threat Criteria to all other ACSPs - Classify ACSPs an non-safety of flight/fracture critical, and apply durability criteria and asses the effect of environmental threats to the ACSP.

A223362 Guide ACSP Material Selection and Setting of Material Allowables - Guide selection of materials that are durable and damage tolerant. and set material allowables based upon analytical and experimental criteria.

A2233621 ACSP Guide based on Stacking Sequence Optimization - Set and optimize material allowables based upon ply stacking sequence.

A2233622 ACSP Guide based on Edge Delamination Criteria - Set and optimize material allowables based upon edge delamination criteria and analyses.

A2233623 ACSP Guide based on Sub-Laminate Buckling Criteria - Set and optimize material allowables based upon sub-laminate buckling criteria and analyses.

A2233624 ACSP Guide based on Design Details - Set and optimize material allowables based upon design detail criteria, 1/4" crack/hole criteria, and analyses.

A2233625 ACSP Guide based on Experimental Results/Validated Analysis Methods - Set and optimize material allowables based upon experimental results and correlated/validated analyses, and 1/4" crack/hole criteria.

A223363 Set ACSP Non-Destructive Inspection Allowables - Set non-destructive inspection allowables based upon delamination and void content criteria.

A223364 Create ACSP Durability and Damage Tolerance Analysis Decision Record - Create a record of the decisions made during the durability and damage analyses and assessments..

A2241 Receive and Review ACSP Class 1 and 2 Changes - Receive and review all the shop and field use changes of the ACSP for class 1 and 2 change processes.

A2242 Prepare ACSP Preliminary Modification Package - Prepare a preliminary ACSP modification based on preliminary design changes, analysis, producibility and costs of the class 1 or 2 type changes.

A22421 Prepare ACSP Preliminary Design Changes - Prepare ACSP preliminary design changes based on the change request as received from the shop or the field.

A22422 Conduct ACSP Preliminary Analysis Changes - Prepare ACSP preliminary analysis changes based on the preliminary design change developed from the change request as received from the shop or the field.

A22423 Prepare ACSP Producibility Assessment - Prepare an ACSP producibility assessment of the preliminary design change developed from the change request as received from the shop or the field.

A22424 Develop ACSP Cost Estimates

A2243 Resolve ACSP Class 2 Changes - Resolve the ACSP class 2 shop changes based on the review by the affected functions.

A2244 Conduct ACSP Change Board Reviews - Conduct ACSP change board reviews with the affected functional representatives to arrive at a consensus on the suggested changes.

A2245 Incorporate ACSP Changes - Incorporate the detail design and analysis changes along with creating and resolving the material and processes, AMRs and released production drawing changes.

A22451 Conduct ACSP Detail Design Changes - Conduct the detail design changes necesssary to meet the approved change requests.

A22452 Conduct ACSP Detail Analysis Changes - Conduct the detail analysis changes necesssary to meet the detail design change created from the approved change requests.

A22453 Resolve ACSP M&P Parameters - Resolve the ACSP Material and Processes parameters necessary to support the detail design change.

A22454 Prepare ACSP AMRs - Prepare the necessary advance material requests for the materials necessary to be received by the shop for manufacture of the design change.

A22455 Release ACSP Production Drawing Changes - Release the necessary ACSP production drawing changes to the shop for the manufacturing processes.

A23 Build and QA an ACSP - The conversion of a design into a finished product and quality assurance functions that assure that the product meets design requirements. This is usually a repetitive function, continuing substantially throughout the product's life cycle. It receives the design from Design Functions and outputs the products, spare and repair ACSPs, and technical data on each instance of the product.

A231 Plan for Manufacturing - Translate Engineering product data into manufacturing plans including major assembly breaks, sub-assembly breaks, major tools, facilities, and equipment requirements, as well as make-buy plans.

A2311 Assume a Structure & Method of Manufacture - Establish production breaks, Major Unit configurations, & major subassemblies, make tentative make or buy decisions and a tooling & assembly overall plan.

A2312 Estimate Requirements Time & Cost to Produce - Estimate resource needs, cost to purchase or make, and timing to start-up and production.

A2313 Develop Production Plans - Develop a top level plan of production including assembly, tooling and space, and detail ACSP fabrication requirements.

A2314 Develop Support Activities Plan - Develop a strategy plan for meeting QA requirements, Materials plans, tooling policy, approach, and major requirements, facilities & equipment requirements, and Personnel Requirements.

A2315 Determine Detail Method of Manufacture - Define a manufacturing bill of materials (BOM) and for each item of that BOM define a manufacturing method and vendor purchase plan.

A23151 Complete Manufacturing Parts List - The parts list per the manufacturing breakdown is completed.

A23152 Determine Make/Buy Decisions - Whether to make or buy the ACSPs on the parts list is determined based upon program parameters, ACSP complexity, and economic factors.

A23153 Determine Precise Form of Sub-Parts - Determine the form of sub-parts (e.g., forged, cast, sheet stock, etc.). that will provide the most economical production of an ACSP that meets all design requirements. The form of sub-parts may change during the life cycle of a program.

A232 Develop ACSP Production Plans - Translate the overall strategy plans (developed in A1) into specific build activity definition suitable for shop floor workers.

A2321 Develop ACSP Process Plans - Define the detail of the assembly and manufacturing methods and sequence such that it can be released to the shop.

A23211 Plan Structures Assembly - Define the installation steps necessary to assemble the structure as well as define tools required.

A23212 Plan Systems Installations - Define the installation steps to install systems (electronic & hydraulic) as well as define tools required.

A23213 Develop Sheet Metal Planning - Define fabrication of parts from cutting and forming sheet metal. (This process is included for reference purposes only and will not be decomposed.)

A23214 Develop Machine Parts Planning - Define Machine Parts Fabrication including NC Programs, holding and cutting tools, and set-ups. (This process is included for reference purposes only and will not be decomposed.)

A23215 Develop ACSP Bonding/Composite Planning - Define Composite Part Fabrication detail planning.

A232151 Conduct Pre-planning Review - Design data is received and a preplanning review is conducted. Any design documentation issues are resolved. -

A232152 Identify New Tool Requirements and Issue Tool Orders - Tool requirements are identified and a request for tooling is created.

A232153 Develop Work Instructions and Build Sequence - The steps necessary to build the composite part are identified and documented for shop floor distribution.

A2321531 Identify Standard Operations and Sequence - Standard operations for this type of ACSP are selected from the standard operations library and placed in the proper sequence.

A2321532 Generate Custom Operations and Sequence - Any non-standard operations are written and inserted in the proper sequence.

A2321533 Insert Inspections Steps - All required sequence steps are placed in the correct sequence based upon the procedures and standards for this program and type of ACSP.

A2321534 Identify and Resolve Issues - Information missing from the build package is identified and cognizant personnel are notified and the problems are resolved.

A232154 Review Planning with Affected Organizations - A meeting is set up with all affected organizations to review the planning data prior to the final audit. This step is primarily a review of the wording and sequence of the operation steps.

A232155 Audit & Verify Planning - The planning is reviewed for completeness and accuracy to the released design before it is released to build.

A232156 Provide Mod Planning - Modification of existing ACSPs is prepared as required either as the result of design changes or rework for discrepancies.

A23216 Plan for Procured Parts - Add manufacturing requirements for procured parts.

A2322 Develop Support Activities Plans - Define Plans for support activities such as materials, quality assurance, tooling, facilities, equipment, and personnel.

A2323 Control, Validate, & Release Planning - Perform the administrative and managerial tasks necessary to assure that the planning is current with engineering definition and properly approved for production.

A233 Provide Tools - Perform the tasks required to design, build, and control configuration of tools defined in A1 & A3.

A2331 Design Tools - Provide engineering definition of tools.

A23311 Generate Design Criteria - Conduct a tooling producibility review which creates a design criteria and a request to design a tool.

A23312 Conduct Preliminary Tool Design - Determine the approach to be used for the tool design, including supporting structure type, rigidity required, transportability requirements, autoclave loading and heating requirements, and bagging and pull-down requirements.

A233121 Review Tooling Concept - The preliminary tool concept is reviewed and expanded.

A233122 Select Tool Material - Based on ACSP and use criteria, select the material required for the face sheet. This decision considers in-house mfg capability, life required, and costs.

A233123 Select Configuration Type - Determine the final configuration of the tool.

A23313 Perform Detail Tool Design - Complete the detail definition of the tool design, including presentation of the design in suitable format.

A23314 Review and Approve Tool Design - Validate Tool Design fit, form, & function . Validate tool design to product design. Release tool design to manufacture.

A2332 Develop NC Programs/Tapes - Provide the Numerical Control Programs needed to fabricate tools.

A23321 Provide Production and Tool N/C Programs - Develop and Debug NC programs to perform inspection operations (inspect tool designs and ACSPs), and perform fabrication operations (ACSPs and tools).

A233211 Obtain Geometry Data - The data defining the geometry of the ACSP is obtained and translated, if required, into electronic format.

A233212 Define Automatted Process Strategy - Define the strategy for producing the tool.

A233213 Define NC Motion Data - Define the motion required to produce the tool based on the parameters from the tooling strategy.

A233214 Generate Documentation - Generate the documentation necessary to operate the N/C programs.

A233215 Post Process NC Program - Process the NC code so that it will be compatible with specific hardware (controller).

A23322 Control NC Programs - Provide serialized identification and validate the configuration of the program for the desired application.

A23323 Proof NC Programs - Schedule NC proofing and validate Tool NC program by simulation or on machine.

A23324 Release NC Programs - Transfer NC media to tool Fabrication Storage.

A2333 Fabricate/Rework Tools - Make and/or refurbish tools.

A2334 Provide Liaison Support - Support tool fabrication and tool tryout in production by providing expertise and resolution of problems.

A234 Procure ACSP Manufacturing Materials - Obtain all materials required to produce ACSP. This includes receiving, inspection, certification, and storage.

A2341 Control Procurement of ACSP Material - Identify the material types, quantities, and date needed for all materials required to build an ACSP. Involves certifying vendors, generating purchase orders, and monitoring the procurement process.

A2342 Procure Material - Generate the required purchase orders and order materials from approved vendors.

A2343 Receive & Inspect Raw Materials - Receive materials, and process and record critical information about the raw materials required to build composite parts. The operations include unloading and storing the materials and verifying that the materials were transported in an approved fashion. As in the case of refrigerated materials, that the proper temperature was maintained. Suitable test samples are taken and sent to the test lab.

A23431 Verify/Record Vendor Documentation - The information from the vendor must be verified as to the content of the shipment and the count/condition. Warehouse personnel verify the contents of the shipment and match that information against the shipper documentation.

A23432 Update & Print Receiving Documentation - The appropriate internal documentation recording the vendor, batch/lot, and material code are printed and placed with the material for identification.

A23433 Unload Transport - The contents of the transport are removed and placed in an inspection area.

A23434 Inspect/Verify Material - The contents are inspected per the inspection plan for that type of material. This inspection is to verify that the shipping documentation accurately reflects what was shipped, materials were not damaged and properly handled during shipment and the material meets the basic requirements set forth in the inspection plan.

A23435 Obtain Test Samples - Most raw materials will have a sample randomly removed and sent to the test lab. Results of the inspection are recorded and determine if the material may be released for production use. This requires thawing of the frozen material.

A23436 Place Material into Proper Storage Area - After the inspection is completed and the test samples are removed the material will be placed into the proper storage area. Storage areas for cold storage must remain at or near 0 degree F. Ambient material must be stored in a clean, dry environment.

A2344 Manage and Control Material Inventory - Provide segregated storage space for bonded (not certified for use) and material available for use. Provide accurate inventories and monitor the usage critical materials.

A235 Produce Product (ACSP) - The composite details are produced and assembled into the correct structure. Each step is completed and then inspected to ensure that the ACSPs produced meet the design requirements.

A2351 Perform Production Operations - The materials and tools required to produce the ACSP's are located and taken to the proper work station. the operations required to build the ACSP are performed and the ACSP is cured. The cured ACSP is then trimmed and drilled as required and then inspected to verify the processes involved. Quality assurance steps are executed during every step of the process.

A23511 Obtain Material - Material for composite manufacturing fall into two categories: cold and ambient. Cold storage materials must be removed from storage and brought to room temperature prior to use. Ambient material are usually ready for use as is. The material identity must be verified against the production planning for the ACSP.

A235111 Remove Material From Storage/Freezer - The material identity is verified and the material is removed from the freezer and placed in a thawing area. The date and time that the material is removed for the freezer must be recorded to monitor the out-time for that material.

A235112 Thaw Material - The material must remain in the thawing area until the material is all at room temperature. This will prevent condensation from forming when the material is used. The amount of time spent thawing must be recorded and fall within the specification for thawing time for that material.

A235113 Cut Material To Size & Kit - The thawed material is unrolled and cut to specific shapes per the production planning. The material may be cut either manually or on automated equipment (e.g. rapid ply cutter). The pieces of material for a single ACSP are then placed together in a material kit. The identity of the material and the pieces of the material in the kit are verified.

A235114 Transport Material - The material kits are transported to the layup station at the proper time for subsequent operations.

A23512 Obtain & Prepare Tools - The tool must be thoroughly cleaned and a release agent is applied to all bonding surfaces. The release agent prevents the ACSP from sticking to the tool. The cleaning operation and the application of the release are inspected and the results are recorded.

A235121 Remove Tool From Storage - The location of the correct tool is obtained and the tool is taken to the cleaning station.

A235122 Clean Tool - The tool surface and undercarriage is carefully cleaned using a combination of dry compressed air and suitable solvents. The tool must be cleaned well enough to meet clean room specifications. The tool cleaning process is then inspected.

A235123 Apply Release Agent - The release agent is applied to the surface of the tool that will come into contact with any material. The coating is then inspected for proper coverage and thickness. Some release agents only need to be reapplied after several production cycles.

A235124 Cure Release Agent & Inspect - The release agent may be air dried or oven cured. The drying time and method is recorded.

A23513 Layup & Assemble ACSP - The material is placed in the proper orientation on the bond mold. The operator follows the instructions on the production planning and certifies each step as it is completed. As each layer is completed, bagging material is sealed over the ply and the layer is vacuum compacted. (This ensures a tights fit of the material on top of the previous layer and removes any trapped air.) The layer is then inspected to ensure the placement and orientation of the material is correct per the design data. This sequence of operations is repeated until all of the layers of material are in place. The various laminate details are then bought to the assembly station. The details are placed in the proper orientation for the completed ACSP. When the ACSP is fully assembled sensors are positioned, appropriate bagging materials (e.g. breather cloth, vacuum bag, etc.) is placed over the ACSP and a vacuum is drawn.

A23514 Bag & Leak Check ACSP - The final bagging operation prior to the curing cycle requires placement of several layers of bagging material, sealing the bag to the tool and pulling a vacuum. The operation must be checked to ensure no vacuum leaks occur.

A235141 Obtain Bagging Material & Cut to Fit - The various materials required are removed from the rolls and cut the appropriate size. Materials include breather cloth, teflon tape, teflon cloth, bagging material, etc.

A235142 Seal Bag - After the material are in place the top layer of bagging material is sealed to the tool using a caulk like sealant. The sealant must be a continuous bead around the entire periphery of the part to prevent leaks.

A235143 Pull Vacuum & Adjust Bag - Vacuum connections are placed in the bag, as needed, and sealed. The connection are hooked up to a full vacuum source and a vacuum is applied. The mechanic will adjust the position of the bag to ensure there is full contact on the part (e.g. no bridging).

A235144 Leak Check Bag & Inspect - The bag is then gauged to determine the amount of vacuum lost over a specified period of time. Any leaks that being the allowables are sealed. The Q/A Inspector verifies that the bagging operation conforms with all applicable specifications and then "buys off" the operation.

A2352 Cure & Tear Down ACSP - The part is placed in the appropriate appropriate curing equipment and the appropriate sensor are attached. the curing cycle is completed, validated, and recorded and the ACSP is removed. The ACSP is separated from the bagging materials and the tooling. The ACSP is transported to the next operation and the tools returned to storage.

A23521 Load Part in Cure Equipment - The parts are placed on a rack and all thermocouple, vacuum, and heat sensors are connected to the parts. The rack is then moved into the autoclave and the connections are made to the autoclave control system.

A23522 Connect Vacuum Sensors & Thermocouples - The sensors are attached to the curing equipment (autoclaves, heated press, oven, etc.) and the connections are verified.

A23523 Cure/Debulk/Bond/Dry per Specification - The appropriate cycle of heat and/or pressure are applied. All parameters about the cycle are recorded and verified.

A23524 Perform Tear Down Operations - The bagging material are removed and discarded. the part is then separated from the bond mold and sent to the next operation. The bond mold is sent to the storage area to await the next cycle.

A2353 Trim & Drill ACSP - The periphery, internal cutouts, and holes are cut/drilled manually and using automated equipment.

A23531 Position Part in Trim/Drill Fixtures - The part is placed and secured in a fixture that will hold the part in placed while the trim & drill operations are competed. Some parts require individualized fixture while most use vacuum universal holding fixtures.

A23532 Trim/ Drill Part - The trimming operations are performed using manual routers, NC routers, abrasive water jet cutters, etc. Drilling operations are usually manual but may be performed utilizing NC drills. Each operations is inspected.

A235321 Trim Part Periphery - The periphery of the part is trimmed manually or using automated equipment. Each trimming operation step is inspected.

A235322 Trim Stiffeners - The edges of each stiffeners are trimmed manually or using automated equipment. The trimming operation is then inspected.

A235323 Drill Holes - For manual drilling operations the part is placed into a drill fixture and the holes are drilled. Automated drilling involves placing the part into a holding fixture and then having the NC equipment drill the holes.

A235324 Inspect Trim & Drill Operations - Each trim and drill operation is inspected to ensure the operation is within tolerance. The results of the inspection are recorded.

A23533 Remove Part From Fixture - The part is removed from the holding fixture using an appropriate material handling device.

A2354 Assure Product Quality - All composite parts have the dimensions and internal structure of the parts inspected. Also the materials, tools, and personnel involved are certified.

A23541 Perform Non-Destructive Inspections - Verify that there are no voids, delaminations, porosity, cracks etc. are contained within the structure of the part. Also verify that all parts dimensions are within allowed tolerances.

A235411 Seal Part For Ultrasonic Inspection - Core stiffened panels are sealed prior to ultrasonic inspection.

A235412 Perform Ultrasonic Inspection Operation - The composite parts and standards are placed in the ultrasonic test equipment and are scanned. The technician will then evaluate the part based upon the variations in the attenuation levels between the part and the standard.

A235413 Perform X-ray Inspection Operations - Any parts that have anomalies that cannot be readily determined by the ultrasonic inspection are x-rayed. The part is loaded on a holding fixture and the questionable area is x-rayed. The x-ray operations are performed based upon inspection techniques that are developed for each part.

A235414 Perform Dimension/Visual Inspection - All parts are inspected using the engineering drawings to verify part dimensional tolerances. A visual inspection of all part surfaces is made to ensure no surface defects exist.

A23542 Perform Material Evaluation/Certification - All materials used in the manufacture of composite parts must be evaluated and certified prior to use. These tests evaluate the physical and mechanical properties of the materials and determine if they fall within accepted limits.

A235421 Obtain Material and/or Test Coupons - Material samples are obtained when the material arrives at the receiving dock. The material is thawed, if required, and appropriate samples are removed based on inspection plans. Test coupons are layed up along with part and are cut from the part during the trim operation. The material samples and test coupons are sent to the test lab area for storage. The raw material is then cured into test coupons for analysis.

A235422 Verify Chemical/Thermal Properties - The material is taken to test lab and the appropriate tests are completed. If the material test are within acceptable limits, the material is released for use by production. All test information is recorded.

A235423 Verify Physical Properties - The test coupons are descriptively tested to verify that the physical properties are within acceptable limits. The results of the test will determine if the material is acceptable. In the case of a part it will determine if the part cured properly.

A235424 Verify Mechanical properties - The test coupons are descriptively tested to verify that the physical properties are within acceptable limits. This determines if the part was properly cured.

A23543 Analyze Defects & Disposition Part or Material - The results of the inspections and tests that failed are carefully analyzed to determine if and how the problem can be corrected.

A236 Ship Product - When the part is complete it must be transported to the major assembly operation, or the customer, in a manner that prevents any damage to the part.

A2361 Print & Verify Transportation Documents - Information about the part must be printed or transferred to a medium that allow the data to be transmitted to the next operation or the customer. For transfer to subsequent operations the planning and manufacturing data must be verified. For parts to the customer all critical build and manufacturing data must be provided.

A2362 Protect Part for Shipment - The part will be wrapped in a protective layer of a protective material, usually bubble wrap. If the part is to be transported outside the plant, a suitable transportation container is used.

A2363 Load Transport - The part is placed on an appropriate transport vehicle and secured as to prevent damage or load shift during transport.

A24 Support Logistics of an ACSP

A241 Perform ACSP Logistics Engineering - Perform the necessary ACSP logistics engineering necessary to meet the customer requirements.

A242 Support ACSP Reliability/Maintenance Design Studies - Support the ACSP reliability and maintainability design studies required to meet the customer requirements.

A243 Write ACSP Technical Manuals and Maintenance Documents - Write ACSP technical manuals and maintenance documents that are specific to the design features of the par

A244 Conduct ACSP Spares - Conduct the necessary ACSP spares support for the customer in the field.

A245 Support ACSP Facilities - Support the necessary ACSP customer facilities as required by the contract.

A246 Plan and Support ACSP Training System - Plan and support the necessary ACSP training systems as required by the customer.

A3 Use & Maintain an ACSP - This activity is the DoD's use and maintenance of an ACSP. It also includes repair, redesign, and modification activities of an ACSP at an ALC.

A4 Develop & Prepare ACSP Materials - This activity is the material suppliers process of creating stock material for composite manufacturers. Basic material properties and allowables are addressed here.

PART SPECIFIC DEFINITIONS

A131 Layup & Assemble 'T' Composite Assembly - The material is placed in the proper orientation on the layup molds. The operator follows the instructions on the production planning and certifies each step as it is completed. As each layer is completed, bagging material is sealed over the ply and the layer is vacuum compacted. The layer is then inspected to ensure the placement and orientation of the material is correct. This sequence of operations is repeated until all of the layers of material are in place. Each component of the assembly is completed and assembled in the final configuration.

A1311 Layup 'L' Channels - The material is placed in the proper orientation on the layup molds. The operator follows the instructions on the production planning and certifies each step as it is completed. As each layer is completed, bagging material is sealed over the ply and the layer is vacuum compacted. The layer is then inspected to ensure the placement and orientation of the material is correct. This sequence of operations is repeated until all of the layers of material are in place. Each component of the assembly is completed and assembled in the final configuration.

A13111 Clean Channel Tool - Immediately prior to each use, both bond tools and assembly tools, are cleaned to prevent any contamination of the materials.

A13112 Position Ply on 'L' Channel Tooling - In accordance with the planning the ply details are placed in position until the entire ply is completed. The operations are performed per the appropriate specification and procedures.

A13113 Compact Ply & Inspect - The ply is covered with breather cloth and an appropriately shaped piece of bagging material is placed over the ply and sealed to the layup tool. Vacuum ports are placed in the bag and sealed. A vacuum is applied and the mechanic ensures that the bag is evenly in contact with the entire ply (e.g. no bridging). A full vacuum is pulled and the held for the amount of time in the specification appropriate for this part. Each ply is verified and bought off by the Q/A Inspector.

A13114 Inspect Layup - The Q/A Inspector verifies that the ply conforms with the design and all applicable specifications and then "buys off" the operation.

A1312 Layup Radius Filler - The proper number of strands of tow are wound in a long bundle. The process involves winding the tow around two pegs placed on a table, but may also be performed by pulforming.

A13121 Wind Roving & Cut to Length - The bundle of tow is cut to length based on the planning.

A13122 Place Roving in Tool - The bundle of roving is placed in a tool with the proper radius for the assemble.

A13123 Compact Roving - The roving is covered with breather cloth and an appropriately shaped piece of bagging material is placed over the roving and sealed to the layup tool. Vacuum ports are placed in the bag and sealed. A vacuum is applied and the mechanic ensures that the bag is evenly in contact with the entire roving (e.g. no bridging). A full vacuum is pulled and the held for the amount of time in the specification appropriate for this part detail.

A13124 Inspect Filler - The Q/A Inspector verifies that the filler conforms with the design and all applicable specifications and then "buys off" the operation.

A1313 Assemble 'L' Channels & Filler - The two 'L' channels are placed side by side per the directions in the planning. Assembly tooling is placed to hold the channels during subsequent assembly operations and curing. The radius filler is then placed in the void created where the two channels come together.

A13131 Position 'L' Channels - The two channels are placed together so the proper 'T' shape of the completed part is created.

A13132 Position Filler - The filler is placed in the void created where the two 'L' channels come together.

A13133 Install Assembly Tools & Inspect - Assembly tools are placed to hold the two channels and their layup tools in a rigid position. The Q/A Inspector verifies that the ply conforms with the design and all applicable specifications and then "buys off" the operation.

A1314 Layup Cap & Inspect Assembly - In accordance with the planning the ply details are placed in position until the entire ply is completed. The operations are performed per the appropriate specification and procedures.

A13141 Position Cap Ply Detail - In accordance with the planning the ply details are placed in position until the entire ply is completed. The operations are performed per the appropriate specification and procedures.

A13142 Compact Ply & Inspect - The ply is covered with breather cloth and an appropriately shaped piece of bagging material is placed over the ply and sealed to the layup tool. Vacuum ports are placed in the bag and sealed. A vacuum is applied and the mechanic ensures that the bag is evenly in contact with the entire ply (e.g. no bridging). A full vacuum is pulled and the held for the amount of time in the specification appropriate for this part. Each ply is verified and bought off by the Q/A Inspector. The Q/A Inspector verifies that the ply conforms with the design and all applicable specifications and then "buys off" the operation.

A13143 Position Caul Plate - A flat metal sheet (caul plate) is placed over the cap to provide an even pressure on the skin during cure and an improved surface finish.

A13144 Inspect Assembly - The Q/A Inspector verifies that the ply conforms with the design and all applicable specifications and then "buys off" the operation.

A132 Layup & Assemble Composite Solid Laminate - The material is placed in the proper orientation on the bond mold. The operator follows the instructions on the production planning and certifies each step as it is completed. As each layer is completed, bagging material is sealed over the ply and the layer is vacuum compacted. This ensures a tights fit of the material on top of the previous layer and removes any trapped air. The layer is then inspected to ensure the placement and orientation of the material is correct. This sequence of operations is repeated until all of the layers of material are in place.

A1321 Clean CSL Tool - Immediately prior to each use, both bond tools and assembly tools, are cleaned to prevent any contamination of the materials.

A1322 Position CSL Ply Detail - The layup operations may be competed manually or using automated equipment. These require placing pre-preg material on a bond mold or layup that is the shape of the completed part or part detail. Layup involves placing a layer of material in various orientations on the tool. These operations are completed per the production planning for that part.

A1323 Compact CSL Ply Detail & Inspect - The ply is covered with breather cloth and an appropriately shaped piece of bagging material is cut and placed over the ply and sealed to the layup tool. Vacuum ports are placed in the bag and sealed. A vacuum is applied and the mechanic ensures that the bag is evenly in contact with the entire ply (e.g. no bridging). A full vacuum is pulled and the held for the amount of time in the specification appropriate for this part. Each ply is verified and bought off by the Q/A Inspector.

A1324 Inspect CSL Layup - The Q/A Inspector verifies that the ply conforms with the design and all applicable specifications and then "buys off" the operation.

A133 Layup & Assemble Core Stiffened Panel - The Core Stiffened Panel (CSP) is a mild contoured, co-cured core sandwich.

A1331 Build Core Assembly - The core details are cut to size , machined to shape, and then formed. Additional operations include the application of potting compound and stabilizers. Multiple core details are attached together using foaming adhesive to form the core assemblies.

A13311 Cut Core to Size - The core is removed from storage and cut to size on a band saw per the instructions on the production planning and to the dimensions on the design data.

A13312 Perform Machining Operations - After the core is cut to size the machining operations are completed. This consists of bevelling the edges using a 5-axis router. The machining operations are then inspected.

A13313 Perform Core Forming Operations - The proper dies are placed in the core forming equipment and the core material is put into position. The core is then formed using heat and pressure. The core is removed from the dies, cooled, then inspected.

A13314 Apply/Cure Stabilizers/Potting Compounds - Potting compounds are used to fill the voids in the core and stabilizers are added to improve the rigidity of the material. After the compounds and stabilizers are added to the core they must be oven cured. Each operation is inspected and the oven cure cycle parameters are recorded.

A13315 Apply Adhesive/Assemble Core - Multiple core details are glued together to form the core assembly. Foaming adhesive is placed on the pieces of core and then the core is matted together. After the core is matted, the adhesive is oven cured. Each operation is inspected and the oven cure cycle parameters are recorded.

A13316 Inspect Core Assemblies - The final completed core assembly is given a final visual/dimensional inspection. The results of the inspection are recorded and the core assembly is released for use in the subsequent operations.

A1332 Layup IML Skin - The material is placed in the proper orientation on the bond mold. The operator follows the instructions on the production planning and certifies each step as it is completed. As each layer is completed, bagging material is sealed over the ply and the layer is vacuum compacted. The layer is then inspected to ensure the placement and orientation of the material is correct. This sequence of operations is repeated until all of the layers of material are in place.

A13321 Clean Tool - Immediately prior to each use, both bond tools and assembly tools, are cleaned to prevent any contamination of the materials.

A13322 Position IML Ply - In accordance with the planning the ply details are placed in position until the entire ply is completed. The operations are performed per the appropriate specification and procedures.

A13323 Compact IML Ply & Inspect - The ply is covered with breather cloth and an appropriately shaped piece of bagging material is cut and placed over the ply and sealed to the layup tool. Vacuum ports are placed in the bag and sealed. A vacuum is applied and the mechanic ensures that the bag is evenly in contact with the entire ply (e.g. no bridging). A full vacuum is pulled and the held for the amount of time in the specification appropriate for this ACSP. Each ply is verified and bought off by the Q/A Inspector.

A13324 Inspect Layup - A quality control inspection verifies that the operations were performed within specifications and followed the production planning.

A1333 Assemble Core & Skin - The core assembly is placed in the proper position on top of the skin. The fit of the core to the skin is verified and adhesive is placed on the skin under the core. A top layer of plies are then placed over the core.

A13331 Position Core Locating Template - A composite core locating template is placed in position on top of the skin. The template has three locating pins that match the layup tool and a cutout where the core will be positioned on the skin.

A13332 Apply Film Adhesive - A layer of film adhesive, cut to the proper shape is placed on the skin where the core will be positioned.

A13333 Verify Core Fit - A layer of teflon sheet is placed over the film adhesive and the core is placed in position. A piece of bagging material is cut to size and sealed to the layup tool. A vacuum is drawn and the core is pressed into the adhesive. After an appropriate amount of time, the bag is removed and the imprint in the adhesive is checked to determine the fit of the core to the skin. If required, multiple layers of adhesive may be used (max of 3) or the core may have to be machined to fit. When at 95% of the core contact surface are in full contact with the skin, the process is complete.

A13334 Position Core & Inspect - The layer of teflon from the core fit operation is removed, and any additional adhesive, if required, is placed on the skin. The core is then placed on the adhesive based on the core locating template. the position of the core is then verified by a quality assurance inspector.

A1334 Layup OML Skin - After the core is in position more material is placed in the proper orientation over the core. The operator follows the instructions on the production planning and certifies each step as it is completed. As each layer is completed, bagging material is sealed over the ply and the layer is vacuum compacted. This ensures a tights fit of the material on top of the previous layer and removes any trapped air. The layer is then inspected to ensure the placement and orientation of the material is correct. This sequence of operations is repeated until all of the layers of material are in place.

A13341 Position OML Ply - In accordance with the planning the ply details are placed in position until the entire ply is completed. The operations are performed per the appropriate specification and procedures.

A13342 Compact Ply & Inspect - The ply is covered with breather cloth and an appropriately shaped piece of bagging material is cut and placed over the ply and sealed to the layup tool. Vacuum ports are placed in the bag and sealed. A vacuum is applied and the mechanic ensures that the bag is evenly in contact with the entire ply (e.g. no bridging). A full vacuum is pulled and the held for the amount of time in the specification appropriate for this ACSP. Each ply is verified and bought off by the Q/A Inspector.

A13343 Inspect OML Layup - A quality control inspection verifies that the operations were performed within specifications and followed the production planning.

A31 Generate ACSP Geometric Attributes - Generate element geometric attributes such as thicknesses for surface elements, and areas and cross-section dimensions for curve elements.

A311 Generate TCA Geometric Attributes - Generate element geometric attributes such as thicknesses for surface elements, and areas and cross-section dimensions for curve elements.

A3111 Generate TCA Equivalent Cross Sectional Area - Generate equivalent cross sectional area of the stiffener for curve elements.

A3112 Generate TCA Equivalent Cross Sectional Properties - Generate equivalent cross sectional beam properties of the stiffener for curve elements.

A31 Conduct ACSP Static Strength Analyses - Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A311 Conduct TCA Static Strength Analyses - Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A3111 Conduct TCA Composite Joint Analyses - Conduct joint analyses to augment the finite element analyses of the structural part.

A3112 Conduct TCA Composite Fastener Pull-Through Analyses - Conduct fastener pull through analyses to augment the finite element analyses of the structural part.

A3113 Generate TCA Equivalent Thicknesses - Generate equivalent thicknesses for surface elements used to explicitly model the stiffener.

A3114 Conduct TCA Composite Point Stress Analysis - Conduct point stress analyses to augment the finite element analyses of the structural part.

A3115 Conduct TCA Beam Buckling and Crippling Analyses - Conduct stiffener buckling and crippling analyses to augment the finite element analyses of the structural part.

A3116 Conduct TCA Beam Stiffener Pull-off Analyses - Conduct stiffener pull-off analyses to augment the finite element analyses of the structural part.

A312 Conduct CSL Static Strength Analyses - Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A3121 Generate CSL Shell Offsets - Generate shell offsets for surface elements to model off thickness centriod attachment.

A3122 Generate CSL Shear Panel Core Area Equivalents - Generate shear panel core area equivalents for surface elements.

A3123 Generate CSL Equivalent Thicknesses - Generate equivalent thicknesses for surface elements.

A312 Generate CSL Geometric Attributes - Generate element geometric attributes such as thicknesses for surface elements.

A3121 Conduct CSL Composite Joint Analyses - Conduct joint analyses to augment the finite element analyses of the structural part.

A3122 Conduct CSL Composite Fastener Pull-Through Analyses - Conduct fastener pull through analyses to augment the finite element analyses of the structural part.

A3123 Conduct CSL Composite Cutout Analyses - Conduct cutout analyses to augment the finite element analyses of the structural part.

A3124 Conduct CSL Composite Point Stress Analysis - Conduct point stress analyses to augment the finite element analyses of the structural part.

A3125 Conduct CSL Panel Analyses - Conduct panel analyses such as buckling, crippling, transverse loadings, and panel flutter to augment the finite element analyses of the structural part.

A313 Generate CSP Geometric Attributes - Generate element geometric attributes such as thicknesses for surface elements.

A3131 Conduct CSP Composite Joint Analyses - Conduct joint analyses to augment the finite element analyses of the structural part.

A3132 Generate CSP Shear Panel Core Area Equivalents - Generate shear panel core area equivalents for surface elements.

A3133 Generate CSP Solid Element Core Equivalent Properties - Generate the equivalent core properties for solid elements.

A3134 Conduct CSP Composite Point Stress Analysis - Conduct point stress analyses to augment the finite element analyses of the structural part.

A313 Conduct CSP Static Strength Analyses - Conduct various detail analyses such as joint and cutout analyses to augment the finite element analyses of the structural part.

A3131 Generate CSP Shell Offsets - Generate shell offsets for surface elements to model off thickness centroid attachment .

A3132 Conduct CSP Composite Fastener Pull-Through Analyses - Conduct fastener pull through analyses to augment the finite element analyses of the structural part.

A3133 Conduct CSP Composite Cutout Analyses - Conduct cutout analyses to augment the finite element analyses of the structural part.

A3134 Generate CSP Equivalent Thicknesses - Generate equivalent thicknesses (smearing core and face sheets) for surface elements.

A3135 Conduct CSP Panel Analyses - Conduct panel analyses such as buckling, crippling, transverse loadings, and panel flutter to augment the finite element analyses of the structural part.

A32 Define ACSP Structural Configuration

Use the results of the initial analyses to define structural thicknesses, potential stiffeners, and potential core stiffening.

A321 Define TCA Structural Configuration

Use the results of the initial analyses to define structural thicknesses, potential stiffeners, and potential core stiffening.

A3211 Define TCA Initial Ply Orientations

Use the results of initial analyses to define the ply orientations.

A3212 Define TCA Initial Ply Distributions

Use the results of initial analyses to define the ply distributions.

A3213 Define TCA Initial Stiffener Geometry

Use the results of initial analyses to decide if stiffeners are required. If stiffeners are required, select the stiffener geometry.

A322 Define CSL Structural Configuration
Use the results of the initial analyses to define structural thicknesses, potential stiffeners, and potential core stiffening.

A3221 Define CSL Initial Ply Orientation
Use the results of initial analyses to define the ply orientations.

A3222 Define CSL Initial Ply Distribution
Use the results of initial analyses to define the ply distributions.

A323 Define CSP Structural Configuration
Use the results of the initial analyses to define structural thicknesses, potential stiffeners, and potential core stiffening.

A3231 Define CSP Initial Ply Orientations
Use the results of initial analyses to define the ply orientations.

A3232 Define CSP Initial Ply Distribution
Use the results of initial analyses to define the ply distributions.

A3233 Define CSP Initial Core Geometry
Use the results of initial analyses to decide if core is required. If core is required, select the core geometry.

A3234 Define CSP Initial Core Orientation
Use the results of initial analyses to decide if core is required. If core is required, select the core orientation.

A3235 Define CSP Initial Core Distribution
Use the results of initial analyses to decide if core is required. If core is required, select the core distribution.

A331 Integrate & Prepare TCA Assy. Drawings - TBD

A332I Integrate & Prepare CSL Assy. Drawings - TBD

A333 Integrate & Prepare CSP Assy. Drawings - TBD

A34 Input ACSP Anisotropic Material Property Matrices - Input material property matrices data.

A341 Input TCA Anisotropic Material Property Matrices - Input material property matrices data.

A3411 Input TCA Equivalent Cross Sectional Area Modulus of Elasticity - Input the equivalent modulus of elasticity appropriate for idealizing the stiffener as only a curve element with extensional stiffness.

A3412 Input TCA Cross Sectional Anisotropic Material Property Matrices - Input the anisotropic cross sectional beam properties matrices data.

A3413 Input TCA Shell Element Anisotropic Material Property Matrices - Input shell element (for when the stiffener walls are explicitly modelled with surface elements) material property matrices data.

A342 Input CSL Anisotropic Material Property Matrices - Input material property matrices data.

A3421 Input CSL Shell Element Anisotropic Material Property Matrices - Input material property matrices data appropriate for surface elements.

A3422 Input CSL Solid Element Anisotropic Material Property Matrices - Input material property matrices data appropriate for volume elements.

A343 Input CSP Anisotropic Material Property Matrices - Input material property matrices data.

A3431 Input CSP Face Sheet Anisotropic Material Property Matrices - Input face sheet material property matrices data.

A3432 Input CSP Core Anisotropic Material Property Matrices - Input core material property matrices data.

A3433 Input CSP Face Sheet and Core Anisotropic Material Property Matrices - Input face sheet and core (smeared together) material property matrices data.

A42 Optimize ACSP Structural Configuration
Use the results of the initial analyses to optimize structural thicknesses, potential stiffeners, and potential core stiffening.

A421 Optimize TCA Structural Configuration
Perform analyses to optimize the critical dimensions of structural components.

A4211 Optimize TCA Initial Ply Orientations
Optimize the ply orientations.

A4212 Optimize TCA Initial Ply Distributions
Optimize the ply distributions.

A4213 Optimize TCA Initial Stiffener Geometry
Optimize the stiffener geometry.

A422 Optimize CSL Structural Configuration
Perform analyses to optimize the critical dimensions of structural components.

A4221 Optimize CSL Initial Ply Orientation
Optimize the ply orientations.

A4222 *Optimize CSL Initial Ply Distribution*
Optimize the ply distributions.

A423 Optimize CSP Structural Configuration
Perform analyses to optimize the critical dimensions of structural components.

A4231 Optimize CSP Initial Ply Orientations
Optimize the ply orientations.

A4232 Optimize CSP Initial Ply Distribution
Optimize the ply distributions.

A4233 Optimize CSP Initial Core Geometry
Optimize the core geometry.

A4234 Optimize CSP Initial Core Orientation
Optimize the core orientation.

A4235 Optimize CSP Initial Core Distribution
Optimize the core distribution.

APPENDIX D - PAS-C Node Tree Drawings